U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS.

NUTRITION INVESTIGATIONS

IN

PITTSBURG, PA., 1894-1896,

BY

ISABEL BEVIER,
Professor of Natural Science in the Pennsylvania College for Women, Pittsburg.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

LIST OF PUBLICATIONS OF THE OFFICE OF EXPERIMENT STATIONS ON THE FOOD AND NUTRITION OF MAN.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., March 24, 1898.

SIR: I have the honor to transmit herewith a report on investigations of the food habits of a number of families in Pittsburg, Pa., made in 1894–1896 by Miss Isabel Bevier, professor of natural science in the Pennsylvania College for Women at Pittsburg. The report includes six dietary studies, a study of the composition and cost of bread in Pittsburg, and a bakery experiment.

These investigations were made under the immediate supervision of Prof. W. O. Atwater, special agent in charge of nutrition investigations, in accordance with instructions given by the Director of this Office.

In the prosecution of these investigations cordial cooperation and substantial aid were given by the authorities of the Pennsylvania College for Women. Special acknowledgments are also due the board of directors of Kingsley House, the college settlement of Pittsburg. The residents of Kingsley House rendered valuable assistance in the selection of the families whose dietaries were studied; while two of the residents, Miss L. P. Meloy and Miss E. R. Evans, gave much of their time to the practical details of the work.

The samples were prepared for analyses in the laboratory of the Pennsylvania College, where some of the analyses were also made. The major part of the analytical work was carried on in the laboratory of the special agent in charge of nutrition investigations at Middletown, Conn.

Professor Bevier's report is respectfully submitted, with the recommendation that it be published as Bulletin No. 52 of this Office.

A. C. TRUE,
Director.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

NUTRITION INVESTIGATIONS IN PITTSBURG, PA., 1894–1896.

THE DIETARY STUDIES.

The investigations here reported include studies of (1) six dietaries; (2) the composition and prices of baker's bread in Pittsburg; and (3) the composition of bread and the changes which the materials undergo in baking.

The dietaries studied were those of families of men in professional life, mechanics, and day laborers. The range in financial condition was from comparative affluence to actual poverty. The inquiries regarding bakers' bread included observations of the composition and selling price of ten specimens as ordinarily sold in the city. The studies of flour and bread included the composition and cost of the flour and other materials used in baking, the composition of the bread, and the losses of materials during the process of fermenting and baking.

PURPOSE AND PLAN.

The purpose of the studies was to obtain information regarding the condition of living and especially concerning the hygienic and pecuniary economy of the food of people of different classes, more particularly those of limited incomes. The data sought were (1) the income of the family; (2) the outlay for rent and food; and (3) the kind, quality, and quantity of food materials consumed. From these data it is possible by comparison with recognized standards to judge whether the families studied were properly nourished and whether they were wise in their selection and purchase of food; also to point out, in many instances, where a different selection would have furnished a more nutritious and less costly dietary.

The plan here followed is the same as has been explained in accounts of previous investigations carried on under the direction of the United States Department of Agriculture. It may be briefly stated as follows: From the sum of the different food materials on hand at the beginning of the study and those received during the experiment the amounts remaining at the end were subtracted. This gave the

amount of each material actually used. The amounts of the nutritive ingredients were estimated from the amount thus obtained and the composition of each material, as shown by actual analysis, or as assumed from the average of analyses of similar food materials. The animal and vegetable materials in the waste (bread crumbs, bits of meat, prepared food of different sorts, etc.) were separated as accurately as possible and analyzed. This waste did not include the inedible portion (i. e., refuse) of the food, such as bones, shells, skins, seeds, etc. The nutrients in the waste subtracted from those of the food gave the amounts of nutrients actually eaten. Account was kept of the meals taken by the different members of the family and by visitors. A record was also kept of all beverages, condiments, etc., purchased.

As a rule a woman requires less food than a man, and the amount required by children is still less, varying with the age. It is customary to assign certain factors which shall represent the amount of nutrients required by children of different ages, and by women, as compared with an adult man. The various factors which have been adopted are as follows:

Factors used in calculating meals consumed in dietary studies.

One meal of woman equivalent to 0.8 meal of man at moderate muscular labor.
One meal of boy 14 to 16 years of age, inclusive, equivalent to 0.8 meal of man.
One meal of girl 14 to 16 years of age, inclusive, equivalent to 0.7 meal of man.
One meal of child 10 to 13 years of age, inclusive, equivalent to 0.6 meal of man.
One meal of child 6 to 9 years of age, inclusive, equivalent to 0.5 meal of man.
One meal of child 2 to 5 years of age, inclusive, equivalent to 0.4 meal of man.
One meal of child under 2 years of age equivalent to 0.3 meal of man.

These factors are based in part upon experimental data and in part upon arbitrary assumptions. They are subject to revision when experimental evidence shall warrant more definite conclusions. By the use of these factors the number of meals actually taken by each member of the family is calculated into the equivalent number of meals for an adult man. In this way the total number of meals taken by the family is finally expressed in terms of meals per man, and by dividing this latter value by the number of meals taken per day (usually three) the equivalent number of days for one man is obtained. The total nutrients of the food eaten divided by this equivalent number of days for one man gives the amounts of nutrients "per man per day."

DIETARY STANDARDS.

The results of the dietary studies are compared with the results of similar studies made elsewhere, and with the dietary standards for man under different conditions of muscular activity. These so-called dietary standards are for the most part based upon the observed facts of food consumption. The standards[1] which are given below are based upon the assumption that the body requires for its nourishment enough protein to replace all the nitrogenous substances consumed in the body

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 21, p. 206 et seq.; Bul. 46, p. 6.

and enough energy (fuel value) to supply the demand for heat and for muscular and other work. All the nutrients yield energy, but protein alone can build tissue. Therefore a dietary standard is expressed in its simplest form in terms of protein and energy (fuel value).

The proposed American standards, which are somewhat more liberal than those given by European authorities, are as follows:

Standards for daily dietaries (Atwater).

	Protein.	Fuel value.
	Grams.	*Calories.*
Man without muscular work	100	2,700
Man with light muscular work	112	3,000
Man with moderate muscular work	125	3,500

These standards are to be understood simply as tentative estimates of the protein and energy required. They are in no sense to be considered as final.

CHARACTER AND COMPOSITION OF FOOD MATERIALS USED.

In the first three dietary studies samples of the more important food materials were analyzed, and the percentage composition of the samples was assumed to represent that of the material eaten in the dietary. Seventeen specimens were analyzed in connection with dietary No. 43, six with dietary No. 128, and eight with dietary No. 129. No analyses were made in connection with the last three dietary studies (Nos. 189, 190, and 191). In every case when a food material was not analyzed its composition was calculated from the average analyses of similar materials.[1]

The following food materials were analyzed in connection with the studies:

145.[2] *Beef, neck.*—For boiling. No bone. Used in dietary No. 128.

304. *Beef, rump.*—For boiling. No bone. Used in dietary No. 129.

197. *Beef, rib roast.*—Unusually fat. Total weight of sample, 9 pounds; refuse, 1.75 pounds. Price, 15 cents per pound. Used in dietary No. 43.

237. *Beef, round steak.*—Total weight of sample, 4.31 pounds; refuse, 0.5 pound. Price, 15 cents per pound. Used in dietary No. 43.

275. *Beef, round steak.*—No bone. Used in dietary No. 128.

276. *Beef, round steak.*—No bone. Used in dietary No. 129.

341. *Beef, shoulder clod.*—For pot roast. Weight of sample, 6 pounds; no refuse. Price, 12 cents per pound. Used in dietary No. 43.

58. *Beef, short steak.*—Sample, 1.18 pounds. No bone. Price, 10 cents per pound. Used in dietary No. 43.

[1] These averages were taken from U. S. Dept. Agr., Office of Experiment Stations Bul. 28, in the case of studies Nos. 43, 128, and 129. In studies Nos. 189, 190, and 191 figures from a revision of the above bulletin not yet in print were used.

[2] The reference numbers are those used in an unpublished compilation of analyses of American food materials.

411. *Beef, kidneys.*—Total weight, 1.56 pounds; refuse, 0.31 pound. Used in dietary No. 43.
415. *Beef, liver.*—Used in dietary No. 129.
1029. *Veal cutlets.*—Weight of sample, 2.84 pounds; refuse, 0.06 pound. Used in dietary No. 43.
1122. *Calf's liver.*—Weight of sample, 2.09 pounds; refuse, 0.09 pound. Used in dietary No. 43.
1505. *Lamb, leg.*—Weight of sample, 7.12 pounds; refuse, 0.5 pound.
2025. *Pork, loin roast.*—Used in dietary No. 129.
2137. *Pigs' kidneys.*—Used in dietary No. 129.
Lard.—Bought from a farmer—100 per cent pure. Used in dietary No. 43.
Butter.—Fox River creamery. Used in dietary No. 43.
Butter.—Used in dietary No. 128.
Butterine.—Three pounds for 50 cents. Used in dietary No. 129.
Milk.—The first sample was taken in connection with dietary No. 43, the second with dietary No. 128, and the third with dietary No. 129.
5014. *Buckwheat flour.*—Used in dietary No. 43.
5026. *Corn meal, yellow.*—Used in dietary No. 43.
5311. *Wheat flour.*—Used in dietary No. 43.
5079. *Rolled oats.*—Used in dietary No. 43.
5573. *White bread.*—Weight, 3.06 pounds. Cost, 9 cents. Used in dietary No. 128.
5574. *Bread, "home-made."*—Baker's bread. Weight, 2.28 pounds. Cost, 7 cents. The family usually bought stale bread. This, however, was a fresh loaf. Used in dietary No. 129.
Sugar, granulated.—Used in dietary No. 43.
Sugar, coffee.—Used in dietary No. 128.
6521. *Lima beans, dried.*—Used in dietary No. 43.

In Tables 1, 2, and 3 is shown the percentage composition of the different food materials described above. Table 1 shows the composition, as purchased, of such of the foods as contained refuse. Table 2 shows the composition of the edible portion of the different foods. With the exception of the materials given in Table 1, these foods contained no refuse or inedible material, and consequently the analyses given for the edible portion represent also the composition as purchased. In Table 3 the composition of the edible portion of the food materials is calculated to the water-free basis.

TABLE 1.—*Composition, as purchased, of such food materials as contained inedible matter or refuse.*

Kind of food material.	Reference No.	Refuse.	Water.	Protein.	Fat.	Ash.	Fuel value per pound.
Beef:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
Rib roast	197	19.4	38.2	13.2	28.7	0.5	1,455
Round steak	237	11.6	64.3	18.6	4.6	.9	540
Kidneys	411	19.9	63.1	14.1	1.9	1.0	340
Veal:							
Cutlets	1029	2.1	73.8	19.6	3.3	1.2	505
Liver	1122	4.3	69.3	18.9	6.3	1.2	620
Lamb leg	1505	7.0	48.2	16.0	28.0	.8	1,480

TABLE 2.—*Composition of fresh, edible portion of food materials analyzed.*[1]

Kind of food material.	Reference No.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD.							
Beef:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
Boiling piece, neck, free from bone	145	69.3	20.9	8.7	.....	1.1	755
Boiling piece, rump	304	43.1	22.4	33.3	.....	1.2	1,820
Rib roast	197	47.4	16.5	35.5	.....	.6	1,810
Round steak	237	72.7	21.0	5.2	.....	1.1	610
Round steak, free from bone	275	65.2	20.9	12.7	.....	1.2	925
Do	276	61.9	21.0	16.0	.....	1.1	1,065
Average	.....	66.6	21.0	11.3	.....	1.1	.....
Shoulder clod	341	69.0	18.8	11.2	.....	1.0	820
Short steak	58	67.7	19.8	11.5	.....	1.0	855
Kidneys	411	78.7	17.6	2.4	.....	1.3	430
Liver	415	75.0	18.8	3.9	1.0	1.3	535
Veal:							
Cutlets	1029	75.4	20.1	3.3	.....	1.2	515
Liver	1122	72.4	19.8	6.6	.....	1.2	645
Lamb: Leg	1505	51.8	17.2	30.1	.....	.9	1,590
Pork:							
Loin roast	2025	41.1	15.8	42.3	.....	.8	2,080
Kidneys	2137	76.1	17.2	5.5	.....	1.2	550
Lard	.....	.....	.....	100.0	.....	.....	4,220
Butter	.....	7.0	.....	89.5	.....	3.5	3,775
Do	.....	10.3	1.0	86.9	.....	1.8	3,685
Butterine	.....	10.0	.5	86.1	.....	3.4	3,640
Milk	.....	88.0	3.0	3.7	4.6	.7	300
Do	.....	87.7	3.2	2.6	5.8	.7	275
Do	.....	88.1	2.9	3.0	5.3	.7	280
VEGETABLE FOOD.							
Buckwheat flour	5014	12.3	5.2	1.2	80.7	.6	1,650
Corn meal	5026	10.2	9.2	1.5	78.4	.7	1,675
Flour, wheat	5311	9.5	14.4	1.3	74.4	.4	1,705
Rolled oats	5079	1.8	16.9	7.8	71.8	1.7	1,980
White bread	5573	34.6	9.2	.5	54.3	1.4	1,200
Do	5574	35.8	9.7	.7	52.6	1.2	1,185
Average	.....	35.2	9.5	.6	53.4	1.3	1,195
Sugar, granulated	.....	1.4	.....	.....	98.6	.....	1,835
Sugar, coffee	.....	4.6	.....	.....	95.4	.....	1,775
Beans, Lima, dried	6521	12.2	12.8	1.9	69.5	3.6	1,645

[1] With the exception of Nos. 197, 237, 411, 1029, 112, and 1505, these analyses also represent the composition of the foods as purchased.

TABLE 3.—*Composition of water-free substance of edible portion of food materials.*

Kind of food material.	Reference No.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.
ANIMAL FOOD.						
Beef:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Boiling piece, neck, free from bone	145	11.13	68.2	28.3	.....	3.5
Boiling piece, rump	304	6.38	39.4	58.6	.....	2.0
Rib roast	197	5.11	31.3	67.6	.....	1.1
Round steak	237	12.67	77.0	19.0	.....	4.0
Round steak, free from bone	275	9.68	60.0	36.7	.....	3.3
Do	276	9.15	55.2	42.0	.....	2.8
Average	.....	.....	64.1	32.6	.....	3.3
Shoulder clod	341	9.91	60.7	36.1	.....	3.2
Short steak	58	9.79	61.1	35.7	.....	3.2
Kidneys	411	12.87	82.9	11.1	.....	6.0
Liver	415	.....	75.4	15.5	4.1	5.0
Veal:						
Cutlets	1029	13.10	81.6	13.6	.....	4.8
Liver	1122	10.65	71.7	23.9	.....	4.4
Lamb: Leg	1505	5.86	35.6	62.5	.....	1.9

TABLE 3.—*Composition of water-free substance of edible portion of food materials.*—Cont'd.

Kind of food material.	Reference No.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.
ANIMAL FOOD—continued.						
Pork:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Loin roast	2025	4.11	26.8	71.9	.....	1.3
Kidneys	2137	11.02	71.9	22.9	.....	5.2
Lard	.....	.....	.....	100.0	.....	.....
Butter	.....	.....	.....	96.2	.....	3.8
Do	.....	.....	1.1	96.9	.....	2.0
Butterine	.....	.....	.6	95.6	.....	3.8
Milk	.....	.....	25.0	30.9	38.3	5.8
Do	.....	.....	26.0	21.1	47.2	5.7
Do	.....	.....	24.4	25.2	44.5	5.9
VEGETABLE FOOD.						
Buckwheat flour	5014	.....	5.9	1.4	92.0	.7
Corn meal	5026	.....	10.3	1.7	87.3	.7
Flour, wheat	5311	.....	15.9	1.4	82.2	.5
Rolled oats	5079	.....	17.3	7.9	73.1	1.7
White bread	5573	.....	14.1	.8	83.0	2.1
Do	5574	.....	15.1	1.1	82.0	1.8
Average	.....	.....	14.6	1.0	82.5	1.9
Sugar, granulated	.....	.....	.....	.....	100.0	.....
Sugar, coffee	.....	.....	.....	.....	100.0	.....
Beans, Lima, dried	6521	.....	15.6	2.1	77.8	4.5

DETAILS OF THE DIETARY STUDIES.

The details of the six dietary studies follow, with such comments and suggestions for improvement in each case as seemed desirable or warranted.

DIETARY STUDY OF A LAWYER'S FAMILY (No. 43).

The first of the dietary studies here reported was made in the winter of 1895 in the family of a lawyer in comfortable circumstances. The family consisted of the aged grandmother, the father and mother just past middle age, two married daughters with the husband of one of them, two daughters between 12 and 20 years of age, a son about 18 years old, and the maid servant, a woman about 30. There were also numerous visitors. The father suffered from dyspepsia, and as he had a special diet he was not included in the study; the son-in-law was engaged in business; the boy was attending school.

The study began February 25, 1895, and continued 30 days.
The number of meals taken was as follows:

	Meals.
Two men	155
Six women (529 meals × 0.8 meal of man), equivalent to	423
Girl 12 years old (90 meals × 0.6 meal of man), equivalent to	54
Visitors, men	16
Visitors, women (41 meals × 0.8 meal of man), equivalent to	33
Visitor, child, equivalent to	1
Total number of meals taken, equivalent to	682

Equivalent to 1 man 227 days.

In the following tables are recorded the kind and amount of the different foods purchased, wasted, and eaten, together with their composition and cost:

TABLE 4.—*Food materials and table and kitchen wastes in dietary study No. 43.*

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per cent.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Rib, no bone[1]	16.5	35.5	.....	$2.36	5,300	875	1,881	.....
Round, no bone[1]	21.0	5.2	.....	2.40	6,945	1,458	361	.....
Rump, no bone	16.8	25.6	.....	.58	2,265	380	580	.....
Shoulder clod[1]	18.8	11.2	.....	.95	3,760	707	421	.....
Short steak[1]	19.8	11.5	.....	.40	1,840	364	212	.....
Tenderloin steak	14.8	27.3	.....	.44	1,100	163	300	.....
Dried and smoked	31.8	6.8	0.6	.25	455	144	31	3
Kidneys, edible portion[1]	17.6	2.4	.....	.30	1,845	325	44	.....
Total	.....	.....	.....	7.68	23,510	4,416	3,830	3
Veal:								
Chops, no bone	19.4	10.4	.....	1.00	2,095	406	218	.....
Cutlets, no bone[1]	20.1	3.3	.....	.95	2,200	442	73	.....
Liver, edible portion[1]	19.8	6.6	.....	.60	2,095	415	138	.....
Total	.....	.....	.....	2.55	6,390	1,263	429	.....
Lamb:								
Chops, no bone	17.6	28.3	.....	.92	2,200	387	623	.....
Leg, no bone[1]	17.2	30.1	.....	1.00	3,005	517	904	.....
Roast, no bone	17.6	28.3	.....	1.11	3,200	563	906	.....
Stew	15.5	19.1	.....	.22	1,200	186	229	.....
Total	.....	.....	.....	3.25	9,605	1,653	2,662	.....
Pork:								
Ribs	14.1	25.6	.....	.55	1,985	280	509	.....
Bacon	9.2	61.8	.....	.06	170	16	105	.....
Ham, no bone	15.5	39.1	.....	.19	625	97	244	.....
Ham	13.3	33.4	.....	.12	470	63	157	.....
Sausage	12.8	45.4	.8	.24	875	112	397	7
Lard	.....	100.0	.....	.14	6,505	.....	6,505	.....
Total	.....	.....	.....	1.30	10,630	568	7,917	7
Fish, salmon	13.5	8.1	.....	.40	1,215	164	98	.....
Eggs (15.9 per cent shell)	14.9	10.6	.....	3.75	10,775	1,605	1,142	.....
Butter[1]	.....	89.5	.....	8.54	13,510	.....	12,091	.....
Cheese	26.0	34.2	2.3	.20	625	163	214	14
Milk[1]	3.0	3.7	4.6	4.76	55,725	1,672	2,062	2,563
Cream	2.5	18.5	4.5	5.00	18,305	458	3,386	824
Total animal food	.....	.....	.....	37.43	150,290	11,962	33,831	3,411
VEGETABLE FOOD.								
Cereals:								
Barley	9.3	1.0	77.6	.03	365	34	4	283
Buckwheat flour[1]	5.2	1.2	80.7	.61	11,110	578	133	8,966
Corn meal[1]	9.3	1.5	78.4	.17	3,940	366	59	3,089
Flour, wheat	14.4	1.3	74.4	2.17	41,050	5,911	534	30,541
Rice	7.8	.4	79.0	.25	1,520	118	6	1,201
Rolled oats[1]	16.9	7.8	71.7	.42	3,090	522	241	2,216
Bread, baker's	9.5	1.2	52.8	.55	5,105	485	61	2,695
Macaroni	11.7	1.6	72.9	.09	340	40	5	248
Total	.....	.....	.....	4.29	66,520	8,054	1,043	49,239
Sugars:								
Sugar, granulated[1]	.....	.....	98.6	2.07	18,825	.....	.....	18,561
Sugar, brown	.....	.....	95.0	.49	4,425	.....	.....	4,204
Molasses (New Orleans)	2.7	.....	68.0	.07	3,175	86	.....	2,159
Total	.....	.....	.....	2.63	26,425	86	.....	24,924

[1] Analyzed in connection with this dietary.

TABLE 4.—*Food materials and table and kitchen wastes in dietary study No. 43*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
VEGETABLE FOOD—continued.								
Vegetables:	*Per ct.*	*Per ct.*	*Per cent.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Beans, dried	22.3	1.8	59.1	$0.26	3,035	677	55	1,793
Beans, Lima, dried[1]	14.0	1.9	70.1	.14	1,275	178	24	894
Cabbage, edible portion	2.1	.4	5.8	.18	1,930	40	8	112
Corn, canned	2.8	1.3	19.3	.52	1,825	51	24	352
Lettuce	1.1	.3	2.7	.04	285	3	1	8
Onions, edible portion	1.7	.4	9.9	.10	535	9	2	53
Peas, canned	3.6	.2	9.8	.70	5,175	186	11	507
Potatoes (29.9 per cent refuse)	2.1	.1	18.0	1.66	35,855	753	36	6,454
Sweet potatoes (24.9 per cent refuse)	1.8	.7	27.1	.37	3,795	68	27	1,028
Tomatoes, canned	1.2	.2	4.0	.47	6,045	72	12	242
Total				4.44	59,755	2,037	200	11,443
Fruits, etc.:								
Cranberries	.5	.7	10.1	.35	1,475	7	10	150
Oranges, pulp	.8	.6	9.7	1.20	2,440	19	15	237
Prunellas	2.0	.7	58.6	.30	905	18	6	530
Total				1.85	4,820	44	31	917
Total vegetable food				13.21	157,520	10,221	1,274	86,523
Total food				50.64	307,810	22,183	35,105	89,934
Waste	10.2	15.8	24.6		14,795	1,509	2,338	3,639

[1] Analyzed in connection with this dietary.

TABLE 5.—*Weights and percentages of food materials and nutritive ingredients per man per day in dietary study No. 43.*

Kind of food material.	Weights.				Cost.	Total food.				Cost.
	Food material.	Protein.	Fat.	Carbohydrates.		Food material.	Protein.	Fat.	Carbohydrates.	
PER MAN PER DAY.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Beef, veal, and mutton	174	32	31			12.8	33.1	19.7		26.5
Pork, lard, etc	47	3	35			3.5	2.6	22.6		2.6
Fish, etc	5	1				.4	.7	.3		.8
Eggs	47	7	5			3.5	7.2	3.3		7.4
Butter	60		53			4.4		34.4		16.9
Cheese	3	1	1			.2	.7	.6		.4
Milk	245	7	9	11		18.1	7.5	5.9	2.9	9.4
Cream	81	2	15	4		5.9	2.1	9.6	.9	9.9
Total animal food	662	53	149	15	16.5	48.8	53.9	96.4	3.8	73.9
Cereals	293	36	5	217		21.6	36.3	2.9	54.8	8.5
Sugars and starches	117			110		8.6	.4		27.7	5.2
Vegetables	263	9	1	50		19.4	9.2	.6	12.7	8.8
Fruits	21			4		1.6	.2	.1	1.0	3.6
Total vegetable food	694	45	6	381	5.8	51.2	46.1	3.6	96.2	26.1
Total food	1,356	98	155	396	22.3	100.0	100.0	100.0	100.0	100.0

TABLE 6.—*Nutrients and potential energy in food purchased, rejected, and eaten per man per day in dietary study No. 43.*

Kind of food.	Weights and fuel value.				Cost.	Percentages of total food.				
	Protein.	Fat.	Carbohydrates.	Fuel value.		Protein.	Fat.	Carbohydrates.	Fuel value.	Cost.
PER MAN PER DAY.										
Food purchased:	*Grams.*	*Grams.*	*Grams.*	*Calories*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Animal	53	149	15	1,665	16.5	53.9	96.4	3.8	48.0	73.9
Vegetable	45	6	381	1,800	5.8	46.1	3.6	96.2	52.0	26.1
Total	98	155	396	3,465	22.3	100.0	100.0	100.0	100.0	100.0
Waste	7	10	16	185	[1]1.5	6.8	6.7	4.0	5.5	6.8
Food actually eaten	91	145	380	3,280	20.8	93.2	93.3	96.0	94.5	93.2

[1]Estimated.

Discussion of results.—The amount of nutrients per man per day actually consumed by this family agree very closely with averages of the food consumption of professional and business men as found in other dietary studies in the United States. The average of nine dietary studies of families of professional men in Connecticut[1] shows rather more protein (107 grams) and about the same fuel value (3,430 calories). The dietary of a teacher's family in Indiana[2] showed a daily consumption of 106 grams protein and a fuel value of 2,780 calories, while two dietaries of professional men in Chicago[3] showed 104 grams of protein and 2,805 calories of energy. The tentative standard above quoted for a man with light muscular labor calls for 112 grams of protein and a fuel value of about 3,000 calories.

The income of this family was such that economy of diet was not a necessity. Nevertheless in some ways they lived quite economically. This was shown more particularly in their selection and purchase of vegetable food.

Meat was eaten in quite large quantities. Indeed, one-third of the total protein was furnished by beef, veal, and mutton. Of these meats 87 pounds were purchased at a cost of $13.50, or at an average of 15½ cents a pound. As a rule the better cuts of meat were purchased, but not the highest-priced cuts. Contrasted with this family may be cited the family in dietary No. 129 (see p. 22), who expended but $1.92 for 30.6 pounds of beef, or an average of 6⅓ cents a pound.

A large variety of vegetable and cereal food products was used. The cereals naturally furnished the largest return of nutrients for a given expenditure. Wheat flour, buckwheat flour, corn meal, and rolled oats were the most important articles among the cereals, and these four materials furnished collectively as much protein as was contained in the beef, veal, and mutton eaten, and at the same time yielded two and one-third times the energy furnished by these meats.

[1] Connecticut Storrs Sta. Rpt. 1896, p. 155.

[2] U. S. Dept. Agr., Office of Experiment Stations Bul. 32, p. 14.

[3] Not yet published.

In other words, 87 pounds of meat cost $13.50 and furnished 7,332 grams of protein with 94,400 calories, while 130½ pounds of cereals cost but $3.37 and furnished 7,377 grams of protein and 223,000 calories.

This family baked their own bread, thereby effecting a considerable saving from a financial standpoint. One hundred and four and three-quarters pounds of bread was made from 64 pounds of flour. The cost of the flour was $1.54 (2.4 cents a pound). In bakery experiments carried on in New Jersey[1] it was found that the shortening, yeast, and other ingredients used in making bread cost on an average 30 cents per dollar's worth of flour. In the study of the cost of bread in Pittsburg (see p. 43) the cost of the ingredients other than flour was 20 cents per dollar's worth of flour. Forty-five cents would probably be ample allowance for the cost of the shortening and yeast used in this study. In New York City there are public ovens where bread is baked for 1 cent a loaf. The actual cost of fuel would probably not be more than half this amount. The average weight of a loaf may be taken as not far from 1¾ pounds. Fifty cents for the cost of fuel needed to bake 64 pounds of bread is probably a liberal allowance. The total cost of the 104¾ pounds of bread would thus be about $2.60, or 2½ cents a pound. This family paid 4.9 cents a pound for the small amount of baker's bread used. In dietary No. 129 stale bread was purchased for 2½ cents a pound, which was probably as cheap as homemade bread.

Considerable quantities of dried beans were used by this family. The legumes give not only a pleasing variety to the diet, but they are very important, and, in the case of the dried seeds, an economical source of protein.

There are certain vegetable food materials which may be considered as staple articles in all households, whether of the poor or the well-to-do. Such are the cereal products—sugar, potatoes, and perhaps beans and peas. Besides these staple articles, a greater or less variety of other food materials is found, according to the habits of living and the circumstances of the family. Green vegetables, such as corn, cabbage, tomatoes, cucumbers, lettuce, etc.; and the fruits, apples, bananas, oranges, and the like, give relish and variety to the food, but do not add especially to the amount of nutrients.[2] For example, a pound of flour will furnish 0.11 pound of protein and 1,650 calories of energy, a pound of dried beans furnishes 0.22 pound of protein and 1,590 calories, while a pound of cabbage furnishes 0.02 pound of protein and

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 35.

[2] Such foods are undoubtedly of value for the acids and mineral salts which they contain. There are many theories which rest on such an assumption, and references to the value of fruit acids and salts are numerous, particularly in popular articles. The consensus of opinion of leading physiologists seems to be that few definite statements can be made on this subject, since the number of experiments bearing upon it is comparatively limited.

about 150 calories of energy, and a pound of oranges furnishes 0.01 pound of protein and 160 calories of energy.

In Table 7 are given the proportions of digestible nutrients and fuel values in 15 of the more important food materials used by this family. The actual cost per pound of these foods is also shown. It is probable that the nearest whole number represents, as a rule, the price charged:

TABLE 7.—*Cost per pound and amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of the more important food materials used in dietary study No. 43.*

Kind of food material.	Actual cost per pound.	Nutrients and energy in 1 pound.				Nutrients and energy in 10 cents' worth.			
		Protein.	Fat.	Carbohydrates.	Fuel value.	Protein.	Fat.	Carbohydrates.	Fuel value.
Beef:	*Cents.*	*Pound.*	*Pound.*	*Pound.*	*Calories.*	*Pound.*	*Pound.*	*Pounds.*	*Calories.*
Ribs	15.0	0.120	0.255	.....	1,300	0.08	0.17	.....	865
Round	15.0	.196	.047	.....	565	.13	.03	.....	375
Shoulder clod	11.5	.184	.109	.....	800	.16	.10	.....	700
Veal, chops	18.0	.159	.084	.....	650	.09	.05	.....	360
Lamb, roast	15.0	.164	.261	.....	1,405	.11	.17	.....	935
Eggs	13.3	.122	.086	.....	590	.09	.06	.....	445
Butter	28.0	.....	.868	.....	3,665	.....	.31	.....	1,310
Milk	3.9	.029	.036	0.046	290	.07	.09	0.12	750
Wheat flour	2.4	.122	.012	.729	1,635	.51	.05	3.04	6,805
Rolled oats	6.2	.144	.070	.702	1,870	.23	.11	1.13	3.015
Bread, baker's	4.9	.081	.011	.517	1,160	.16	.02	1.06	2.365
Sugar, granulated	5.0	.....	.....	.966	1,795	.....	.....	1.93	3,595
Beans, dried	4.2	.161	.016	.593	1,470	.38	.04	1.41	3.500
Potatoes	1.5	.013	.....	.120	245	.09	.....	.80	1,645
Oranges	10.0	.008	.....	.043	80	.....	.....	.04	80

The digestible nutrients stated in the above table were calculated from the total nutrients by use of the following factors:

Calculated coefficients of digestibility of nutrients in different classes of foods.

	Protein.	Fat.	Carbohydrates.
	Per cent.	*Per cent.*	*Per cent.*
Animal foods	98	97	100
Cereals and starches	85	90	98
Sugars	.....	.....	100
Vegetables and fruits	80	90	95

These factors are based upon the results of recent digestion experiments with men having a mixed diet, and while they are not to be taken as an exact measure of the digestibility of different food materials, it is probable that they represent with a fair amount of accuracy the relative digestibility of different classes of foods.

It will be seen from Table 7 that flour and dried beans were the cheapest sources of protein and that butter and sugar furnished practically no protein. Butter and sugar, however, are valuable sources of energy. Oranges contain little protein and are low in fuel value, but are undoubtedly valuable for the sake of variety and perhaps for some tonic effect which they may exert. Wheat flour is not only the cheapest

source of protein but also of energy. The meats, at the prices paid, were comparatively costly.

The above comparison shows the value of a number of foods on the basis of their composition and fuel value. The individual preference and the income of a family must govern the amount in which many of the food materials furnishing little actual nutritive material should be used. It is not the purpose of this and similar investigations to limit choice in this matter, but rather to furnish data for comparison, leaving deductions to be drawn by those interested. The pleasure derived from a varied dietary may more than offset the difference in cost, within limits, if absolute economy need not be practiced.

DIETARY STUDY OF A MILL WORKMAN'S FAMILY (No. 128).

This study was made with a Polish family living in the Polish section of the city, and dependent upon the iron mills for their support. The study was carried on in the winter of 1896.

The family consisted of the father, 57, and the mother, 47 years of age; four sons, aged 19, 13, 10, and 8 years, respectively; and two daughters of 16 and 6 years. The children were all born in this country.

The father was not a skilled workman, and had been out of employment for some time, but just previous to the beginning of the study had secured work at $1.25 per day. The oldest son had also been idle until a short time before, when he had found work at like wages. The older of the two girls was employed in a cigar factory and earned about $7.50 per week. The mother did all the housework and all the sewing for the family.

This family of eight persons occupied two front rooms on the second floor of a tenement house, paying $5 a month rent. Although their surroundings were dirty the rooms were kept clean and neat.

There was at the time of the study an old grocery bill for $25, which was being gradually reduced.

The study began January 24, 1896, and continued 29 days.
The number of meals taken was as follows:

	Meals.
Two men	174
Woman (87 meals × 0.8 meal of man), equivalent to	70
Girl, 16 years old (87 meals × 0.7 meal of man), equivalent to	61
Two boys, 10 and 13 years old (173 meals × 0.6 meal of man), equivalent to	104
Two children, 6 and 8 years old (174 meals × 0.5 meal of man), equivalent to	87
Visitors	4
Total number of meals taken, equivalent to	500

Equivalent to 1 man 167 days.

In the following tables are recorded the kind and amount of the different foods purchased, wasted, and eaten, together with their composition and cost:

TABLE 8.—*Food materials and table and kitchen wastes in dietary study No. 128.*

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Stew meat, mostly neck, no bone[1]	20.9	8.7	.....	$1.00	7,810	1,632	680	.....
Round, no bone[1]	20.9	12.7	.....	1.65	8,305	1,736	1,054	.....
Bologna sausage	18.0	19.7	.....	.30	1,445	260	285	.....
Suet	4.8	79.9	.....	.....	140	7	112	.....
Total	.....	.....	.....	2.95	17,700	3,635	2,131	.....
Pork:								
Steak	11.7	36.0	.....	.53	2,480	290	893	.....
Pigs' feet, no bone	16.1	14.8	.....	.20	3,035	489	449	.....
Ham, smoked, no bone	15.5	39.1	.....	.45	1,400	217	547	.....
Ham, boiled, no bone	18.2	37.0	.....	1.65	3,970	723	1,469	.....
Bacon	9.2	61.8	.....	.46	1,960	180	1,211	.....
Head-cheese	18.6	24.0	.....	.15	810	151	194	.....
Lard	.....	100.0	.....	.90	3,440	.....	3,440	.....
Total	.....	.....	.....	4.34	17,095	2,050	8,203	.....
Fish:								
Herring, smoked, no bone	36.4	15.8	.....	.20	1,460	531	231	.....
Salmon, canned	20.7	10.8	1.2	.30	855	177	92	.....
Total	.....	.....	.....	.50	2,315	708	323	.....
Eggs, without shell	14.9	10.6	.....	.99	2,735	407	290	.....
Butter[1]	1.0	86.9	.....	3.08	5,480	55	4,762	.....
Cheese, whole milk	26.0	34.2	2.3	.16	470	122	161	11
Cheese, Limburger	23.0	29.4	.4	.12	270	62	80	1
Milk[1]	3.2	2.6	5.8	1.20	19,305	618	502	1,119
Total animal food	.....	.....	.....	13.34	65,370	7,657	16,452	1,131
VEGETABLE FOOD.								
Cereals:								
Barley	9.3	1.0	77.6	.03	255	24	2	198
Flour	11.3	1.1	74.6	.20	2,555	289	28	1,906
Oatmeal	15.6	7.3	68.0	.05	455	71	33	310
Rice	7.8	.4	79.0	.05	455	36	2	359
Bread	9.2	.5	54.3	3.30	44,395	4,084	222	24,107
Cake	7.0	8.1	63.4	.49	2,565	180	208	1,626
Pie	4.7	9.5	39.5	.45	2,585	121	246	1,021
Total	.....	.....	.....	4.57	53,265	4,805	741	29,527
Sugars:								
Sugar, coffee[1]	.....	.....	95.4	1.07	8,210	.....	.....	7,833
Molasses	2.7	.....	68.0	.15	1,755	48	.....	1,193
Total	.....	.....	.....	1.22	9,965	48	.....	9,026
Vegetables:								
Beans	22.3	1.8	59.1	.30	2,350	524	42	1,389
Catsup	1.5	.2	12.3	.10	215	3	.....	26
Peas	24.1	1.1	61.5	.01	115	28	1	71
Onions	1.5	.4	8.9	.04	1,205	18	5	107
Potatoes (23.4 per cent refuse)	2.1	.1	18.0	1.55	48,335	1,015	48	8,700
Tomatoes, canned	1.2	.2	4.0	.20	1,620	19	3	65
Total	.....	.....	.....	2.20	53,840	1,607	99	10,358

[1] Analyzed in connection with this dietary.

TABLE 8.—*Food materials and table and kitchen wastes in dietary study No. 128*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
VEGETABLE FOOD—continued.								
Fruit, etc.:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Apples	1.4	3.0	57.6	$0.05	1,020	14	31	587
Jam	1.1	.....	77.1	.19	570	6	.....	440
Prunes	2.0	.7	58.6	.10	400	8	3	234
Total	.....	.....	.....	.34	1,990	28	34	1,261
Total vegetable food	.....	.....	.....	8.33	119,060	6,488	874	50,172
Total food	.....	.....	.....	21.67	184,430	14,145	17,326	51,303
Accessories:								
Coffee	.....	.....	.....	.51	1,080	.....	.....	.....
Tea	.....	.....	.....	.42	365	.....	.....	.....
Salt	.....	.....	.....	.04	740	.....	.....	.....
Yeast	.....	.....	.....	.02	15	.....	.....	.....
Pepper	.....	.....	.....	.05	25	.....	.....	.....
Mustard	.....	.....	.....	.10	280	.....	.....	.....
Vinegar	.....	.....	.....	.08	855	.....	.....	.....
Total	.....	.....	.....	1.22	.....	.....	.....	.....
Total cost of food and accessories	.....	.....	.....	22.89	.....	.....	.....	.....
Waste:								
Animal[1]	13.5	47.3	.....	.....	945	128	447	.....
Vegetable (bread crumbs)[1]	7.4	3.8	40.0	.....	1,800	133	69	720
Total waste	.....	.....	.....	.....	2,745	261	516	720

[1] Analyzed in connection with this dietary.

TABLE 9.—*Weights and percentages of food materials and nutritive ingredients per man per day in dietary study No. 128.*

Kind of food material.	Weights.				Cost.	Percentages of total food.				Cost.
	Food material.	Protein.	Fat.	Carbohydrates.		Food material.	Protein.	Fat.	Carbohydrates.	
PER MAN PER DAY.										
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Beef, veal, and mutton	106	22	13	.....	.....	9.6	25.7	12.3	.....	13.6
Pork, lard, etc	102	12	49	.....	.....	9.2	14.5	47.3	.....	20.0
Fish, etc	14	4	2	.....	.....	1.2	5.0	1.9	.....	2.3
Eggs	16	3	2	.....	.....	1.5	2.9	1.7	.....	4.6
Butter	33	.....	29	.....	.....	3.0	.4	27.5	.....	14.2
Cheese	4	1	1	.....	.....	.4	1.3	1.4	.....	1.3
Milk	116	4	3	7	.....	10.5	4.3	2.9	2.2	5.5
Total animal food	391	46	99	7	8.0	35.4	54.1	95.0	2.2	61.5
Cereals	319	29	4	177	.....	28.9	34.0	4.3	57.6	21.1
Sugars and starches	60	.....	.....	54	.....	5.4	.3	.....	17.6	5.6
Vegetables	322	10	1	62	.....	29.2	11.4	.5	20.2	10.2
Fruits	12	.....	.....	7	.....	1.1	.2	.2	2.4	1.6
Total vegetable food	713	39	5	300	5.0	64.6	45.9	5.0	97.8	38.5
Total food	1,104	85	104	307	13.0	100.0	100.0	100.0	100.0	100.0

TABLE 10.—*Nutrients and potential energy in food purchased, rejected, and eaten per man per day in dietary study No. 128.*

Kind of food.	Weights and fuel value.					Percentages of total food.				
	Protein.	Fat.	Carbohydrates.	Fuel value.	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.	Cost.
PER MAN PER DAY.										
Food purchased:	*Grams.*	*Grams.*	*Grams.*	*Calories*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Animal	46	99	7	1,140	8.0	54.1	95.0	2.2	44.0	61.5
Vegetable	39	5	300	1,435	5.0	45.9	5.0	97.8	56.0	38.5
Total	85	104	307	2,575	13.0	100.0	100.0	100.0	100.0	100.0
Beverages, condiments, etc	.....	.....	.....	.....	.8	.....	.....	.....	.....	.....
Waste:										
Animal	1	3	.....	30	.....	.9	2.5	.....	1.1	.....
Vegetable	1	.....	4	20	.....	.9	.4	1.4	.9	.....
Total	2	3	4	50	.....	1.8	2.9	1.4	2.0	.....
Food actually eaten:										
Animal	45	96	7	1,110	.....	53.2	92.5	2.2	42.9	.....
Vegetable	38	5	296	1,415	.....	45.0	4.6	96.4	55.1	.....
Total	83	101	303	2,525	.....	98.2	97.1	98.6	98.0	.....

Discussion of results.—As regards surroundings and income the family studied in this dietary may be taken as fairly representative of a large class of very poor foreign laborers in Pittsburg. The family was undernourished. Even as compared with the amounts of nutrients ordinarily required by persons of sedentary habits their diet was scant. To bring it up to the tentative standard for a man with muscular work would have required 50 per cent more protein and 40 per cent more energy; to bring it up to the tentative standard for a man without muscular work would have required 20 per cent more protein and the same proportional increase of energy.

A considerable amount of thrift was shown, but more skill in marketing would have obtained more nutrients for the same outlay of money. Round steak was purchased in considerable quantities at the low price of 9 cents a pound. The meat thus obtained had very little waste and contained a large proportion of protein. Beef for boiling was purchased for 5 cents a pound, and was doubtless just as nutritious as sirloin steak at 18 or 20 cents a pound. Beef stew meat and beef round, pigs' feet, smoked herring, herring, bread, beans, and potatoes were all very economical foods. These eight materials furnished 73 per cent of the protein and 50 per cent of the fuel value. The cost was 39 per cent of the whole, not including the accessories. Boiled ham, canned salmon, eggs, butter, cheese, milk, parsley, and jam were more or less expensive. These eight materials furnished 18 per cent of the protein and 23 per cent of the fuel value. The cost was 32 per cent of the whole. Fish is a valuable source of protein, but as it contains but little fat its fuel value is small. The canned salmon used by this family was not economical, the smoked herring was very

economical. The herring is one of the few oily fishes, and consequently its fuel value is greater than that of most fish. It also contains a large amount of protein.

The food which furnished the least nutriment in proportion to its cost was the boiled ham. Although under ordinary circumstances its use would be justifiable, the means of this family were so limited that it was a more costly food than they could afford. This ham was carried in the dinner pail for lunch, and was purchased daily at a cost of 19 cents per pound. Butter, also, formed a heavy item of expense, one-seventh of the total cost of the food being for this one article. Twenty-five and a half cents a pound may not be high for creamery butter such as this family purchased, but they would have obtained much more actual food if they had spent but half as much for butter and bought more flour, bread, beans, or potatoes. Of course, some butter is desirable not only for the fat it contains, but also for the relish it gives the food and for the sake of variety in food materials. The point to be emphasized is, that in cases where the income is so small that bare subsistence is a difficult problem, some more economical food material might be substituted for a portion of the butter.

The cost per pound, the digestible nutrients as calculated by the factors given on p. 17, and the fuel value of the different food materials are shown in the following table:

TABLE 11.—*Cost per pound and amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of the more important food materials used in dietary study No. 128.*

Kind of food material.	Actual cost per pound.	Nutrients and energy in 1 pound.				Nutrients and energy in 10 cents' worth.			
		Protein.	Fat.	Carbohydrates.	Fuel value.	Protein.	Fat.	Carbohydrates.	Fuel value.
Beef:	*Cents.*	*Pound.*	*Pound.*	*Pound.*	*Calories.*	*Pound.*	*Pounds.*	*Pound.*	*Calories.*
Stew meat	5.0	0.176	0.073	.....	635	0.15	.....	0.35	1,270
Round	8.9	.202	.121	.....	885	.14	.....	.23	995
Bologna sausage	9.4	.176	.191	.....	1,130	.20	.....	.19	1,205
Pork:									
Ham, boiled	18.8	.178	.359	.....	1,845	.19	.....	.09	982
Head-cheese	8.5	.183	.233	.....	1,325	.27	.....	.21	1,555
Fish, herring, smoked	5.9	.339	.145	.....	1,245	.25	.....	.57	2,105
Eggs	14.2	.126	.089	.....	610	.06	.....	.09	430
Butter	25.5	.010	.843	.....	3,575	.33	.....	.....	1,400
Milk	2.8	.031	.025	0.058	270	.09	0.21	.11	970
Flour	3.6	.096	.010	.730	1,580	.03	2.03	.27	4,385
Oatmeal	5.0	.133	.064	.669	1,760	.13	1.33	.27	3,520
Bread	3.4	.078	.....	.532	1,135	.....	1.56	.23	3,340
Sugar, coffee	5.9	.....	.....	.954	1,775	.....	1.61	.....	3,010
Beans	5.8	.178	.016	.561	1,442	.03	.97	.31	2,495
Potatoes	1.1	.013	.....	.130	265	.....	1.18	.12	2,420

DIETARY STUDY OF A MILL WORKMAN'S FAMILY (No. 129).

This dietary study was made with an English family in very poor circumstances. The family consisted of the father and mother, a married daughter and her husband, three younger daughters, one son, and an infant. The father, 43 years of age, was a thin, delicate man, with

an apparent tendency toward consumption. Severe colds frequently prevented him from working, and during the study he lost eight days on this account. He was a blacksmith by trade; his usual wages were $1.25 per day. The mother and the married daughter, 18 years old, were strong and healthy, as was also the son-in-law. The latter was 27 years old and earned $1.25 per day in an iron mill. The daughters, aged 13 and 7 years, respectively, and the 10-year-old boy were all weak and sickly. The two youngest children, a girl 4 years old, and an infant aged 7 months, were strong and robust.

The family paid $6 a month in advance for rent of three rooms.

The study began January 24, 1896, and continued 29 days.

The number of meals taken was as follows:

	Meals.
Two men	173
Two women (173 meals × 0.8 meal of man), equivalent to	139
Two children, 10 and 13 years old (174 meals × 0.6 meal of man), equivalent to	104
Child, 7 years old (87 meals × 0.5 meal of man), equivalent to	44
Child, 4 years old (87 meals × 0.4 meal of man), equivalent to	35
Infant, 7 months old	26
Total number of meals taken, equivalent to	521

Equivalent to 1 man 174 days.

The amount and composition of the food purchased, wasted, and eaten, together with its cost, are shown in the following table:

TABLE 12.—*Food materials and table and kitchen wastes in dietary study No. 129.*

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Chuck	15.7	10.2	.....	$0.40	3,160	496	322	.....
Round, no bone[1]	21.0	16.0	.....	.75	3,820	802	611	.....
Rump[1]	22.4	33.3	.....	.28	2,300	515	766	.....
Fore shank	12.3	7.3	.....	.20	1,765	217	129	.....
Liver[1]	18.8	3.9	1.0	.15	1,800	339	70	18
Leberwurst[2]	12.2	20.2	15.4	.14	1,035	126	209	160
Total	.....	.....	.....	1.92	13,880	2,495	2,107	178
Pork:								
Loin, no bone[1]	15.8	42.3	.....	1.95	9,235	1,459	3,906	.....
Ham, smoked, no bone	15.5	39.1	.....	1.15	5,670	879	2,217	.....
Ham, boiled	18.2	37.0	.....	.10	325	59	120	.....
Bacon	9.2	61.8	.....	.05	215	20	133	.....
Pigs' feet	10.0	9.3	.....	.15	1,715	172	159	.....
Kidney[1]	17.2	5.5	.....	.11	1,200	206	66	.....
Sausage	12.8	45.4	.8	.05	340	44	154	3
Lard, unrendered	1.1	94.0	.....	.26	1,530	17	1,438	.....
Total	.....	.....	.....	3.82	20,230	2,856	8,193	3
Oysters	6.1	1.4	3.3	.10	525	32	8	17
Butterine	.5	86.1	.....	1.45	3,910	20	3,366	.....
Cheese	26.0	34.2	2.3	.50	1,860	483	636	43
Milk[1]	2.9	3.0	5.3	.80	14,745	428	442	781
Total animal food	.....	.....	.....	8.59	55,150	6,314	14,752	1,022

[1] Analyzed in connection with this dietary.

[2] From foreign analyses.

TABLE 12.—*Food materials and table and kitchen wastes in dietary study No. 129*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
VEGETABLE FOOD.								
Cereals:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Flour	11.3	1.1	74.6	$0.44	9,810	1,108	108	7,318
Rolled oats	16.9	7.2	66.8	.02	285	48	21	190
Bread[1]	9.7	.7	52.6	2.45	46,755	4,535	327	24,593
Cake	7.0	8.1	63.4	.20	2,660	186	215	1,687
Pie	4.7	9.5	39.5	.38	3,720	175	353	1,469
Rolls	9.6	5.2	57.3	.20	2,660	256	138	1,524
Sugar	.....	.....	100.0	1.30	10,455	.....	.....	10,455
Total	.....	.....	.....	4.99	76,345	6,308	1,162	47,236
Vegetables:								
Beans	22.3	1.8	59.1	.06	580	129	11	343
Beans, Lima	15.9	1.8	67.1	.15	1,330	212	24	892
Cabbage (16 per cent refuse)	2.1	.4	5.8	.15	4,590	97	18	266
Carrots (21.8 per cent refuse)	1.1	.4	9.2	.05	670	7	3	62
Celery	1.4	.1	3.0	.05	200	3	.....	6
Onions	1.5	.4	8.9	.12	3,445	52	14	306
Parsnips (25 per cent refuse)	1.7	.6	16.1	.05	655	11	4	105
Potatoes (34.6 per cent refuse)	2.1	.1	18.0	.66	21,215	446	21	3,818
Water cress[2]	3.8	.9	8.9	.05	115	5	1	10
Ruta-bagas (23 per cent refuse)	1.3	.2	8.5	.05	2,180	28	5	185
Total	.....	.....	.....	1.39	34,980	990	101	5,993
Fruit, etc.:								
Apples	.4	.4	12.4	.10	1,715	7	7	212
Apple jelly[2]	1.1	.....	77.1	.05	365	4	.....	281
Total	.....	.....	.....	.15	2,080	11	7	493
Total vegetable food	.....	.....	.....	6.53	113,405	7,309	1,270	53,722
Total food	.....	.....	.....	15.12	168,555	13,623	16,022	54,744
Accessories:								
Tea	.....	.....	.....	.71	865	.....	.....	.....
Coffee	.....	.....	.....	.15	270	.....	.....	.....
Salt	.....	.....	.....	.08	1,540	.....	.....	.....
Mustard	.....	.....	.....	.18	440	.....	.....	.....
Yeast	.....	.....	.....	.02	25	.....	.....	.....
Total	.....	.....	.....	1.14	3,140	.....	.....	.....
Total cost of food and accessories	.....	.....	.....	16.26	.....	.....	.....	.....
Waste:								
Animal[1]	6.9	41.3	.....	.....	565	39	233	.....
Vegetable (bread crumbs)[1]	6.4	4.2	31.3	.....	715	46	30	224
Total waste	.....	.....	.....	.....	1,280	85	263	224

[1] Analyzed in connection with this dietary.
[2] Composition assumed, as there are no analyses of such materials.

TABLE 13.—*Weights and percentages of food materials and nutritive ingredients per man per day in dietary study No. 129.*

Kind of food material.	Weights.					Percentages of total food.				
	Food material.	Protein.	Fat.	Carbohydrates.	Cost.	Food material.	Protein.	Fat.	Carbohydrates.	Cost.
PER MAN PER DAY.										
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Beef, veal, and mutton	80	14	12	1	.....	8.2	18.3	13.2	0.3	12.7
Pork, lard, etc	116	16	47	.....	.....	12.0	21.0	51.1	.....	25.3
Fish, etc	3	.....	.....	.....	.....	.3	.2	.....	.1	.6
Butter	22	.....	20	.....	.....	2.3	.1	21.0	.....	9.6
Cheese	11	3	4	.....	.....	1.1	3.6	4.0	.1	3.3
Milk	85	3	2	5	.....	8.8	3.1	2.8	1.4	5.3
Total animal food	317	36	85	6	4.9	32.7	46.3	92.1	1.9	56.8
Cereals	379	36	7	212	.....	39.1	46.3	7.3	67.2	24.4
Sugars and starches	60	.....	.....	60	.....	6.2	.....	.....	19.1	8.6
Vegetables	201	6	.....	34	.....	20.8	7.3	.6	10.9	9.2
Fruits	12	.....	.....	3	.....	1.2	.1	.....	.9	1.0
Total vegetable food	652	42	7	309	3.8	67.3	53.7	7.9	98.1	43.2
Total food	969	78	92	315	8.7	100.0	100.0	100.0	100.0	100.0

TABLE 14.—*Nutrients and potential energy in food purchased, rejected, and eaten per man per day in dietary study No. 129.*

Kind of food.	Weights and fuel value.					Percentages of total food.				
	Protein.	Fat.	Carbohydrates.	Fuel value.	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.	Cost.
PER MAN PER DAY.										
Food purchased:	*Grams.*	*Grams.*	*Grams.*	*Calories.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Animal	36	85	6	965	4.9	46.3	92.1	1.9	39.0	56.8
Vegetable	42	7	309	1,505	3.8	53.7	7.9	98.1	61.0	43.2
Total	78	92	315	2,470	8.7	100.0	100.0	100.0	100.0	100.0
Beverages, condiments, etc	.....	.....	.....	.....	.7	.....	.....	.....	.....	.....
Waste:										
Animal	.....	2	.....	20	.....	.3	1.5	.....	.6	.....
Vegetable	1	.....	1	10	.....	.3	.1	.5	.3	.....
Total	1	2	1	30	.....	.6	1.6	.5	.9	.....
Food actually eaten:										
Animal	36	83	6	945	.....	46.0	90.6	1.9	38.4	.....
Vegetable	41	7	308	1,495	.....	53.4	7.8	97.6	60.7	.....
Total	77	90	314	2,440	.....	99.4	98.4	99.5	99.1	.....

Discussion of results.—This family had the smallest income of any reported, and, as shown by the results of the investigation, were the most poorly nourished. In many ways they were economical, and obtained more for the same amount of money than has often been found to be the case with families in similar circumstances. When they could get together enough money to buy a sack of flour they baked their own bread; otherwise they bought baker's stale bread in small quantities. Instead of butter they used butterine, at 16.8 cents a pound, or lard.

Little can be said with reference to improvement of this dietary. The cost per man per day (9 cents) is exceedingly low.

The cost per pound, and the amounts and the fuel value of digestible nutrients of 1 pound and 10 cents' worth of fifteen of the more important food materials used are shown in the following table:

TABLE 15.—*Cost per pound and amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of the more important food materials used in dietary study No. 129.*

Kind of food material.	Actual cost per pound.	Nutrients and energy in 1 pound.				Nutrients and energy in 10 cents' worth.			
		Protein.	Fat.	Carbohydrates.	Fuel value.	Protein.	Fat.	Carbohydrates.	Fuel value.
Beef:	*Cents.*	*Pound.*	*Pound.*	*Pounds.*	*Calories.*	*Pound.*	*Pound.*	*Pounds.*	*Calories.*
Chuck	5.7	0.154	0.099	.....	705	0.27	0.17	.....	1,235
Round	8.9	.205	.154	.....	1,030	.23	.17	.....	1,160
Rump	5.5	.220	.323	.....	1,770	.40	.59	.....	3,220
Pork:									
Loin	8.7	.141	.373	.....	1,835	.16	.43	.....	2,110
Ham, smoked	8.8	.146	.365	.....	1,810	.17	.41	.....	2,060
Butterine	16.8	.006	.835	.....	3,535	.....	.50	.....	2,105
Cheese	12.2	.255	.332	0.023	1,920	.21	.27	0.02	1,575
Milk	2.5	.028	.029	.053	275	.11	.12	.21	1,090
Flour	2.0	.096	.010	.731	1,580	.48	.05	3.66	7,905
Bread	2.5	.082	.006	.516	1,140	.33	.02	2.06	4,550
Pastry	4.0	.051	.064	.459	1,220	.13	.16	1.15	3,045
Sugar	5.6	.....	.....	1.000	1,860	.....	.....	1.78	3,320
Beans	5.0	.142	.016	.613	1,480	.28	.03	1.23	2,960
Cabbage	1.2	.014	.....	.047	115	.12	.....	.39	940
Potatoes	.9	.011	.....	.112	230	.12	.....	1.24	2,535

As will be seen by reference to the above table, the family used good judgment in their selection and purchase of food, and the smallness of the diet could be remedied with difficulty, unless, as was pointed out for similar cases in the report of dietary studies in New York City,[1] the amount of vegetable foods, such as flour, meal, beans, peas, and potatoes purchased, should be increased and the amount of animal foods correspondingly diminished. At the prevailing market prices, generally speaking, certain of the vegetable foods furnish a cheaper source of nutrients than do the animal foods, and in such an instance as this, where, in spite of the most judicious marketing, there was insufficient nourishment, some of the animal foods could have been advantageously replaced by vegetable foods.

In addition to other food materials, this family consumed 8.4 pounds round steak, 22.4 pounds pork loin, 0.7 pound boiled ham, 0.5 pound bacon, 1.2 pounds oysters, and 4.1 pounds cheese, costing $3.45. If for these materials they had substituted 9 pounds beef rump, 47.5 pounds flour, 10 pounds oatmeal, 17 pounds beans, and 94.4 pounds potatoes, which could also have been purchased for $3.45, the total cost of the diet would have remained unchanged. The family, however, would have obtained 101 grams of protein and 3,120 calories per man per day, instead of 78 grams protein and 2,465 calories which were furnished by the daily diet actually eaten.

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 46, p. 65.

This family expended 57 per cent of the total cost of their food for meat and other animal foods, and these furnished but 46 per cent of the protein and 39 per cent of the energy. In other words, if they had eaten somewhat less beef, pork, and butterine and more beans, peas, flour, and oatmeal, they would have gotten more actual nutriment for the same money without materially lessening the attractiveness of the diet, provided proper care was taken in the preparation of the food.

DIETARY STUDY OF A BOILER TENDER'S FAMILY (No. 189).

This dietary study was made in an English family, consisting of the father, mother, and five children, the eldest about 8 years of age. The father, a healthy man 32 years of age, was boiler tender in an office building and earned about $42 a month. The mother, a woman of 28 years, seemed well but had not been very strong since the birth of the last child. The children were all born in this country. The three oldest, boys of 8, 6, and 4 years of age, were healthy and apparently well nourished. A girl of 2 seemed rather delicate, but the youngest child, a girl of 3 months, was very robust.

During the hard times the husband had been out of work and had contracted some debts. The payment of these debts was taking all the spare money at the time the study was made. The family paid $6 a month rent for three rooms, but were looking forward to the time when they could move into a tenement of four rooms at a rent of $9.

The study began January 12, 1897, and continued 8 days.

The number of meals taken was as follows:

	Meals.
Man	24
Woman (24 meals × 0.8 meal of man), equivalent to	19
Two children, 6 and 8 years old (48 meals × 0.5 meal of man), equivalent to	24
Two children, 2 and 4 years old (48 meals × 0.4 meal of man), equivalent to	19
Infant, equivalent to	7
Total number of meals taken, equivalent to	93

Equivalent to 1 man 31 days.

In the following table are recorded the kind and amount of the different foods purchased, wasted, and eaten, together with their composition and cost:

TABLE 16.—*Food materials and table and kitchen wastes in dietary study No. 189.*

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Fore shank (1.5 per cent refuse)	19.6	11.6	.....	$0.45	2,655	520	308	.....
Steak, shoulder	19.3	11.3	.....	.40	1,535	296	173	.....
Total	.....	.....	.....	.85	4,190	816	481	.....
Veal chops (16.3 per cent refuse)	19.4	10.4	.....	.25	580	113	60	.....

TABLE 16.—*Food materials and table and kitchen wastes in dietary study No. 189*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD—continued.								
Pork:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Ham (31.6 per cent refuse)	15.5	39.1	.....	$0.71	3,105	481	1,214	.....
Steak (7.9 per cent refuse)	13.4	41.8	.....	.23	1,005	135	420	.....
Lard	.....	100.0	.....	.16	720	.....	720	.....
Total	.....	.....	.....	1.10	4,830	616	2,354	.....
Sunfish[1]	6.8	7.5	.....	.15	795	54	60	.....
Eggs (31.9 per cent refuse)[2]	15.0	11.0	.....	.10	215	32	24	.....
Butter	.....	82.4	.....	.74	1,675	.....	1,380	.....
Milk	3.3	4.0	5.0	.90	13,090	432	524	654
Total animal food	.....	.....	.....	4.09	25,375	2,063	4,883	654
VEGETABLE FOOD.								
Cereals:								
Flour	11.4	1.1	75.1	.67	11,200	1,277	123	8,411
Rolled oats	16.6	7.2	66.9	.23	2,070	343	149	1,385
Rice	7.8	.4	79.2	.20	960	75	4	760
Bread	9.4	1.2	53.0	.27	3,985	375	48	2,112
Cakes	6.9	8.7	62.0	.10	425	29	37	264
Crackers, soda	9.8	9.5	73.3	.04	240	23	23	176
Pies	4.2	10.5	40.8	.10	495	21	52	202
Total	.....	.....	.....	1.61	19,375	2,143	436	13,310
Sugar	.....	.....	100.0	.47	3,885	.....	.....	3,885
Vegetables:								
Beans, baked	6.9	3.1	19.6	.10	920	63	29	189
Onions (5 per cent refuse)	1.7	.4	10.2	.02	270	5	1	27
Potatoes (20.6 per cent refuse)	2.2	.1	18.8	.32	12,835	282	13	2,413
Total	.....	.....	.....	.44	14,025	350	43	2,620
Fruit, etc.:								
Lemons (58.3 per cent refuse)	1.0	.9	8.3	.05	170	2	1	14
Apple butter[1]	1.2	.1	58.5	.25	1,190	14	1	696
Total	.....	.....	.....	.30	1,360	16	2	710
Total vegetable food	.....	.....	.....	2.82	38,645	2,509	481	20,525
Total food	.....	.....	.....	6.91	64,020	4,572	5,364	21,179
Accessories:								
Baking powder	.....	.....	.....	.09	85	.....	.....	.....
Ginger	.....	.....	.....	.04	85	.....	.....	.....
Pepper	.....	.....	.....	.01	15	.....	.....	.....
Salt	.....	.....	.....	.02	845	.....	.....	.....
Coffee	.....	.....	.....	.14	225	.....	.....	.....
Tea	.....	.....	.....	.63	565	.....	.....	.....
Total	.....	.....	.....	.93	1,820	.....	.....	.....
Total cost of food and accessories	.....	.....	.....	7.84	.....	.....	.....	.....
Waste:								
Shoulder steak	19.3	11.3	.....	.....	15	3	2	.....
Veal chops	20.2	6.2	.....	.....	25	5	2	.....
Total animal waste	.....	.....	.....	.....	40	8	4	.....
Bread	9.4	1.2	53.0	.....	15	1	1	8
Total waste	.....	.....	.....	.....	55	9	5	8

[1] Composition assumed.

[2] This large percentage of refuse must have included more or less waste as well. Inasmuch, however, as the total weight of eggs used is very small, the figures for the amount of refuse are given as reported.

TABLE 17.—*Weights and percentages of food materials and nutritive ingredients per man per day in dietary study No. 189.*

Kind of food material.	Weights.				Cost.	Percentages of total food.				Cost.
	Food material.	Protein.	Fat.	Carbohydrates.		Food material.	Protein.	Fat.	Carbohydrates.	
PER MAN PER DAY.										
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Beef, veal, and mutton	154	30	17	.....	.....	7.5	20.3	10.1	.....	15.9
Pork, lard, etc	156	20	76	.....	.....	7.5	13.5	43.9	.....	15.9
Fish, etc	26	2	2	.....	.....	1.2	1.2	1.1	.....	2.2
Eggs	7	1	1	.....	.....	.3	.7	.4	.....	1.5
Butter	54	.....	45	.....	.....	2.6	.....	25.8	.....	10.7
Milk	422	14	17	21	.....	20.5	9.4	9.8	3.1	13.0
Total animal food	819	67	158	21	13.2	39.6	45.1	91.1	3.1	59.2
Cereals	625	69	14	429	.....	30.3	46.9	8.1	62.8	23.3
Sugars and starches	125	.....	.....	125	.....	6.0	.....	.....	18.4	6.8
Vegetables	452	11	1	85	.....	22.0	7.7	.8	12.4	6.4
Fruits	44	.....	.....	23	.....	2.1	.3	.....	3.3	4.3
Total vegetable food	1,246	80	15	662	9.1	60.4	54.9	8.9	96.9	40.8
Total food	2,065	147	173	683	22.3	100.0	100.0	100.0	100.0	100.0

TABLE 18.—*Nutrients and potential energy in food purchased, rejected, and eaten per man per day in dietary study No. 189.*

Kind of food.	Weights and fuel value.				Cost.	Percentages of total food.				Cost.
	Protein.	Fat.	Carbohydrates.	Fuel value.		Protein.	Fat.	Carbohydrates.	Fuel value.	
PER MAN PER DAY.										
Food purchased:	*Grams.*	*Grams.*	*Grams.*	*Calories*	*Cts.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Animal	67	158	21	1,830	13.2	45.1	91.1	3.1	36.4	59.2
Vegetable	80	15	662	3,180	9.1	54.9	8.9	96.9	63.6	40.8
Total	147	173	683	5,010	22.3	100.0	100.0	100.0	100.0	100.0
Beverages, condiments, etc	.....	.....	.....	.....	3.0	.....	.....	.....	.....	.....
Waste (animal)[1]	.....	.....	.....	.....	.....	.2	.1	.....	.1	.3
Food actually eaten:										
Animal	67	158	21	1,830	.....	44.9	91.0	3.1	36.3	58.9
Vegetable	80	15	662	3,180	.....	54.9	8.9	96.9	63.6	40.8
Total	147	173	683	5,010	.....	99.8	95.9	100.0	99.9	99.7

[1] The quantity of waste was so small as to amount to practically nothing per man per day.

Discussion of results.—The family previously studied (dietary No. 129) was undernourished. This family went to the other extreme, since, on the assumption that their food requirements were the average of people in like circumstances, they consumed more than the dietary standards show to be necessary. None of the family was at very active labor, and it is probable that 110 or 115 grams of protein, with a fuel value of 3,000 to 3,300 calories, would have amply supplied their wants and needs. It would seem that the daily amount of protein consumed (147 grams) was not far from 30 per cent in excess of what was required, and the fuel value (5,010 calories) 70 per cent in excess.

Had they purchased smaller amounts of the same food materials at the same price the total expense might have been reduced from a fourth to a third.

The selections of food materials were made with considerable judgment, and the prices were, in general, moderate. Meats were purchased by the day, but all other foods were procured in large quantities.

The actual prices paid are shown in the following table, which also gives the amounts and fuel value of digestible nutrients in 1 pound and 10 cents' worth of fifteen of the more common food materials used:

TABLE 19.—*Cost per pound and amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of the more important food materials used in dietary study No. 189.*

Kind of food material.	Actual cost per pound.	Nutrients and energy in 1 pound.				Nutrients and energy in 10 cents' worth.			
		Protein.	Fat.	Carbohydrates.	Fuel value.	Protein.	Fat.	Carbohydrates.	Fuel value.
Beef:	*Cents.*	*Pound.*	*Pound.*	*Pound.*	*Calories.*	*Pound.*	*Pound.*	*Pounds.*	*Calories.*
Fore shank	7.6	0.189	0.110	.....	815	0.25	0.14	.....	1,075
Steak, shoulder	11.8	.189	.109	.....	810	.16	.09	.....	690
Veal, chops	16.3	.160	.083	.....	650	.10	.05	.....	395
Pork:									
Ham	10.1	.147	.367	.....	1,825	.14	.37	.....	1,810
Steak	9.5	.120	.372	.....	1,790	.13	.39	.....	1,885
Butter	20.0	.....	.800	.....	3,315	.....	.40	.....	1,690
Milk	3.1	.032	.039	0.050	320	.10	.13	0.16	1,025
Flour	2.7	.097	.010	.736	1,590	.36	.04	2.73	5,890
Rolled oats	5.0	.141	.065	.655	1,755	.28	.13	1.31	3,510
Rice	9.4	.066	.004	.776	1,585	.07	.....	.83	1,685
Bread	3.1	.080	.011	.519	1,160	.26	.03	1.67	3,740
Pastry	9.4	.053	.087	.542	1,475	.06	.09	.58	1,570
Beans, baked	4.9	.055	.028	.186	565	.11	.06	.38	1,155
Potatoes	.9	.013	.....	.141	285	.14	.....	1.57	3,180
Apple butter	9.5	.009	.001	.573	1,085	.01	.....	.60	1,140

Beef shank, flour, oatmeal, and bread were the cheapest sources of protein and (with the exception of the beef shank) of energy also. Ten per cent of the total expenditure was for butter, although the price per pound was not very high. If less butter had been eaten, the cost of the food would have been diminished and the excessive fuel value of the diet would have been lowered. A pecuniary saving was not undesirable since, although the circumstances of this family were much better than those of Nos. 128 and 129, they found it difficult to "make both ends meet." The total income was about $42 a month. The expenditures were $9 for rent and $29 for food and beverages, leaving but $4 per month for other expenses.

It is perhaps unwarranted to draw the deduction that this family were habitually supplied with an excess of nutrients, for it is doubtful if their ordinary living habits are accurately portrayed in the dietary study. The time covered by the investigation was very short. It was planned to continue it for one month, as was done in the majority of the dietary studies. At the end of eight days the mother refused to permit the continuance of the investigation. The excuse given was that the neighbors were convinced that it was a scheme to see how much it

actually cost for a man to live, in order that his wages might be reduced, and so in order to keep on good terms with her neighbors she must discontinue the study. It was thought, however, by those having charge of the study that the family had eaten rather more than usual to make a good showing, and that they could not afford to keep it up. Perhaps both reasons influenced the decision to discontinue the study.

While the data thus obtained are not as satisfactory and reliable as in the other studies here reported, they are still of considerable interest. It is evident that the woman understood how to purchase food advantageously and showed good management in the kitchen, otherwise the amount of nutrients could never have been purchased for the price paid.

DIETARY STUDY OF A DECORATOR'S FAMILY (No. 190).

This dietary study was made in a Swiss family in quite comfortable circumstances. The family consisted of the father, mother, and three children. The father, a healthy man 44 years of age, was a house decorator and in business for himself. His income was estimated to be $84 a month. They paid $13 a month rent for a four-room house with garret, cellar, and laundry. Everything about the place was very neatly kept.

The mother, a rather frail woman of 36 years, was an Austrian by birth, but came to this country when a child. She was a good manager, and had at one time, when her husband was out of work for over a year, supported the family by doing washing. The children—a girl of 15, and two boys, aged 12 and 2, respectively—were all in good health.

The study began January 14, 1897, and continued 30 days.

The number of meals taken was as follows:

	Meals.
Man	[1] 58
Woman (90 meals × 0.8 meal of man), equivalent to	72
Girl, 15 years old (89 meals × 0.7 meal of man), equivalent to	62
Boy, 12 years old (90 meals × 0.6 meal of man), equivalent to	54
Child, 2 years old (90 meals × 0.4 meal of man), equivalent to	36
Visitors, women (5 meals × 0.8 meal of man), equivalent to	4
Visitor, man	1
Total number of meals taken, equivalent to	287

Equivalent to 1 man 96 days.

The tables which follow give in detail the amount and composition of the food purchased, wasted, and eaten, together with its cost.

[1] Dinners were taken at a restaurant.

TABLE 20.—*Food materials and table and kitchen wastes in dietary study No. 190.*

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Chuck (4.8 per cent refuse)	19.0	12.6	.....	$0.63	2,875	546	362	.....
Neck	13.9	11.9	.....	.12	655	91	78	.....
Rib (44.9 per cent refuse)	17.0	26.6	.....	.50	1,760	299	468	.....
Steak, shoulder (8.3 per cent refuse)	16.1	9.8	.....	.10	425	68	42	.....
Steak, porterhouse	18.2	20.3	.....	1.05	2,990	544	607	.....
Shank (10.3 per cent refuse)	19.8	11.5	.....	.86	4,705	932	541	.....
Liver pudding [1]	20.9	5.0	1.6	.07	465	96	24	7
Total	.....	.....	.....	3.33	13,875	2,576	2,122	7
Veal:								
Chops (13.7 per cent refuse)	19.4	10.4	.....	.20	540	105	56	.....
Cutlet (2.8 per cent refuse)	20.8	9.9	.....	.15	465	97	46	.....
Rib roast (9.2 per cent refuse)	20.2	6.2	.....	.50	1,520	307	94	.....
Shank (1.2 per cent refuse)	19.9	4.6	.....	.30	1,095	218	50	.....
Shoulder (4.8 per cent refuse)	20.1	8.2	.....	.23	810	162	66	.....
Total	.....	.....	.....	1.38	4,430	889	312	.....
Lamb:								
Chops, shoulder (15 per cent refuse)	17.5	29.7	.....	.20	790	138	235	.....
Chops, ribs (14.6 per cent refuse)	17.6	28.3	.....	.10	270	48	76	.....
Total	.....	.....	.....	.30	1,060	186	311	.....
Pork:								
Bacon	8.9	62.5	.....	.10	365	33	228	.....
Chops, fat (11.8 per cent refuse)	12.2	45.0	.....	.18	635	77	286	.....
Chops (11.6 per cent refuse)	16.7	31.3	.....	.35	1,320	220	413	.....
Ham (12.4 per cent refuse)	15.5	39.1	.....	1.05	3,775	585	1,476	.....
Shank (23.1 per cent refuse)	15.5	29.4	.....	.42	2,600	403	764	.....
Shoulder, smoked (5.5 per cent refuse)	15.8	32.5	.....	.15	1,250	198	406	.....
Steak	11.7	36.0	.....	.10	365	43	131	.....
Sausage	12.7	44.2	1.1	.52	2,245	285	992	25
Lard	.....	100.0	.....	.44	2,060	.....	2,060	.....
Total	.....	.....	.....	3.31	14,615	1,844	6,756	25
Oysters	6.0	1.3	3.3	.10	595	36	8	19
Eggs (11.5 per cent refuse)	15.0	11.0	.....	.67	1,875	281	206	.....
Butter	.....	82.4	.....	1.60	2,995	.....	2,468	.....
Milk	3.3	4.0	5.0	2.15	32,590	1,075	1,304	1,629
Total animal food	.....	.....	.....	12.84	72,035	6,887	13,487	1,680
VEGETABLE FOOD.								
Cereals:								
Barley	9.3	1.0	77.6	.03	285	26	3	221
Corn meal	9.3	2.4	74.9	.05	940	87	23	704
Flour, wheat	11.4	1.1	75.1	1.14	19,480	2,221	214	14,630
Rice	7.8	.4	79.2	.05	255	20	1	202
Bread	9.4	1.2	53.0	.28	3,955	372	48	2,097
Bread, rye	9.9	.6	54.5	.04	710	70	4	387
Cake	6.9	8.7	62.0	.10	580	40	50	360
Crackers, oyster	10.1	10.6	71.6	.03	200	20	21	143
Total	.....	.....	.....	1.72	26,405	2,856	364	18,744
Sugar	.....	.....	100.0	.15	1,245	.....	.....	1,245
Vegetables:								
Beans, dried	22.4	1.8	59.1	.08	1,375	308	25	812
Beets (6.4 per cent refuse)	1.5	.1	9.8	.10	3,090	46	3	303
Cabbage (12.8 per cent refuse)	1.9	.3	5.7	.21	5,895	112	18	336
Corn, canned	2.8	1.3	19.3	.30	1,770	50	23	341

[1] Composition assumed.

TABLE 20.—*Food materials and table and kitchen wastes in dietary study No. 190*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
VEGETABLE FOOD—continued.								
Vegetables—Continued.								
Onions (17 per cent refuse)	*Per ct.* 1.7	*Per ct.* 0.4	*Per ct.* 10.2	$0.03	*Grams.* 200	*Grams.* 3	*Grams.* 1	*Grams.* 20
Peas, canned	3.6	.2	9.8	.09	595	22	1	58
Pickles	.6	.3	3.4	.04	765	5	2	26
Potatoes (15.5 per cent refuse)	2.2	.1	18.8	.52	21,625	476	22	4,065
Potatoes, sweet (25.6 per cent refuse)	1.8	.7	27.4	.18	4,155	75	29	1,138
Soup greens	4.2	.6	6.3	.01	15	1	.....	1
Turnips (27.8 per cent refuse)	1.3	.2	8.1	.05	920	12	2	74
Turnips, Swedish (31.4 per cent refuse)	1.3	.2	8.1	.05	1,985	26	4	161
Catsup	1.5	.2	12.3	.04	300	4	1	37
Chili sauce [1]	.6	.3	3.4	.40	965	6	3	33
Sauerkraut	1.7	.5	3.8	.10	1,335	23	6	51
Total	.....	.....	.....	2.20	44,990	1,169	140	7,456
Fruits, etc.:								
Apples (6.3 per cent refuse)	.4	.5	15.2	.60	22,985	92	115	3,493
Bananas (19.6 per cent refuse)	1.2	.7	22.0	.28	2,730	33	19	600
Oranges (10.8 per cent refuse)	.8	.6	9.7	.10	1,010	8	6	98
Lemons (37.4 per cent refuse)	1.0	.9	8.3	.05	260	3	2	22
Peaches, canned	.5	.2	7.5	.34	1,940	10	4	145
Plum butter [1]	1.2	.1	58.5	.61	3,315	40	3	1,939
Total	.....	.....	.....	1.98	32,240	186	149	6,297
Total vegetable food	.....	.....	.....	6.05	104,880	4,211	653	33,742
Total food	.....	.....	.....	18.89	176,915	11,098	14,140	35,422
Accessories:								
Coffee	.....	.....	.....	.25	2,300	.....	.....	.....
Tea	.....	.....	.....	.13	25	.....	.....	.....
Pepper	.....	.....	.....	.10	25	.....	.....	.....
Salt	.....	.....	.....	.01	3,120	.....	.....	.....
Vinegar	.....	.....	.....	.03	465	.....	.....	.....
Total	.....	.....	.....	.52	5,935	.....	.....	.....
WASTE.								
Beef:								
Chuck	19.0	12.6	.....	.10	470	89	59	.....
Rib (trimmings)	11.8	25.0	.....	.15	540	64	135	.....
Shank	19.8	11.5	.....	.13	710	141	82	.....
Liver pudding [1]	20.9	5.0	1.6	.19	125	26	6	2
Veal: Shank	19.9	4.6	.....	.02	75	15	3	.....
Pork:								
Chops	16.7	31.3	.....	.01	25	4	8	.....
Ham	15.5	39.1	.....	.02	60	9	24	.....
Total animal waste	.....	.....	.....	.62	2,005	318	317	2
Potatoes	2.2	.1	18.8	.01	625	13	1	118
Total waste	.....	.....	.....	.63	2,630	361	318	120

[1] Composition assumed.

TABLE 21.—*Weights and percentages of food materials and nutritive ingredients per man per day in dietary study No. 190.*

Kind of food material.	Weights.				Cost.	Percentages of total food.				Cost.
	Food material.	Protein.	Fat.	Carbohydrates.		Food material.	Protein.	Fat.	Carbohydrates.	
PER MAN PER DAY.										
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Beef, veal, and mutton	202	38	29	.....	.....	10.9	32.9	19.4	.....	26.7
Pork, lard, etc	152	19	70	.....	.....	8.3	16.6	47.8	0.1	17.6
Fish, etc	6	1	.....	.....	.....	.3	.3	.....	.....	.5
Eggs	19	3	2	.....	.....	1.1	2.5	1.5	.....	3.6
Butter	31	.....	26	.....	.....	1.7	.....	17.5	.....	8.5
Milk	340	11	13	17	.....	18.4	9.7	9.2	4.6	10.9
Total animal food	750	72	140	17	13.3	40.7	62.0	95.4	4.7	67.8
Cereals	275	30	4	195	.....	14.9	25.7	2.6	52.9	9.5
Sugars and starches	13	.....	.....	13	.....	.7	.....	.....	3.5	.4
Vegetables	469	12	2	78	.....	25.5	10.6	1.0	21.1	11.7
Fruits	336	2	1	66	6.3	18.2	1.7	1.0	17.8	10.6
Total vegetable food	1,093	44	7	352	6.3	59.3	38.0	4.6	95.3	32.2
Total food	1,843	116	147	369	19.6	100.0	100.0	100.0	100.0	100.0

TABLE 22.—*Nutrients and potential energy in food purchased, rejected, and eaten per man per day in dietary study No. 190.*

Kind of food.	Weights and fuel value.				Cost.	Percentages of total food.				Cost.
	Protein.	Fat.	Carbohydrates.	Fuel value.		Protein.	Fat.	Carbohydrates.	Fuel value.	
PER MAN PER DAY.										
Food purchased:	*Grams.*	*Grams.*	*Grams.*	*Calories*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Animal	72	140	17	1,665	13.3	62.0	95.4	4.7	49.8	67.8
Vegetable	44	7	352	1,690	6.3	38.0	4.6	95.3	50.2	32.2
Total	116	147	369	3,355	19.6	100.0	100.0	100.0	100.0	100.0
Beverages, condiments, etc	.....	.....	.....	.....	.5	.....	.....	.....	.....	.....
Waste:										
Animal	4	3	.....	45	.....	3.1	2.3	.....	1.3	3.3
Vegetable	.....	.....	1	5	.....	.1	.....	.3	.2	.....
Total	4	3	1	50	.....	3.2	2.3	.3	1.5	3.3
Food actually eaten:										
Animal	68	137	17	1,620	.....	58.9	93.1	4.7	48.5	64.5
Vegetable	44	7	351	1,685	.....	37.9	4.6	95.0	50.0	32.2
Total	112	144	368	3,305	.....	96.8	97.7	99.7	98.5	96.7

Discussion of results.—Considerable thrift and good management was evident in this family. The amounts of nutrients and energy in the food, while hardly up to the tentative standard for a man at moderate manual labor, which calls for 125 grams of protein and 3,500 calories fuel value, were nearly the same as the average of nine dietary studies made among mechanics' families in Connecticut.[1] As previously stated, the average income of the man was estimated at $84 per month. The food for the family of five cost $20 and the rent was $13 a month, or a total outlay for food and rent of $33. The sum expended for food

[1] Connecticut Storrs Sta. Rpt. 1896, p. 154.

was very reasonable. Skill was shown in the choice and purchase of food materials. The variety of meats was large, including seven different cuts of beef, five of veal, one of lamb, and seven of pork. All were, however, purchased at very reasonable prices. There was considerable variety also in the vegetable foods obtained.

The cost per pound and the amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of fifteen of the more important food materials used are shown in the following table:

TABLE 23.—*Cost per pound and amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of the more important food materials used in dietary study No. 190.*

Kind of food material.	Actual cost per pound.	Nutrients and energy in 1 pound.				Nutrients and energy in 10 cents' worth.			
		Protein.	Fat.	Carbohydrates.	Fuel value.	Protein.	Fat.	Carbohydrates.	Fuel value.
Beef:	*Cents.*	*Pound.*	*Pound.*	*Pound.*	*Calories.*	*Pound.*	*Pound.*	*Pounds.*	*Calories.*
Chuck	9.5	0.177	0.116	.....	820	0.19	0.12	.....	860
Ribs	10.2	.132	.205	.....	1,110	.13	.20	.....	1,110
Shank	8.1	.190	.110	.....	815	.23	.14	.....	1,010
Veal, rib roast	13.6	.179	.054	.....	560	.13	.04	.....	410
Pork, ham	11.0	.133	.328	.....	1,630	.12	.30	.....	1,485
Eggs	13.9	.126	.091	.....	620	.09	.07	.....	445
Butter	24.2	.....	.799	.....	3,370	.....	.33	.....	1,395
Milk	3.0	.032	.039	0.050	320	.11	.13	0.17	1,060
Flour, wheat	2.7	.097	.010	.736	1,590	.36	.04	2.73	5,895
Bread	3.2	.080	.011	.519	1,160	.25	.03	1.62	3,625
Beans, dried	2.6	.179	.016	.561	1,445	.69	.06	2.16	5,555
Corn, canned	7.7	.022	.012	.183	430	.03	.16	.24	560
Potatoes	.9	.014	.....	.149	305	.16	.....	1.66	3,378
Chili sauce	18.8	.....	.....	.032	60	.....	.....	.02	32
Apples	1.1	.....	.....	.139	260	.....	.....	1.26	2,355

DIETARY STUDY OF A GLASS BLOWER'S FAMILY (No. 191.)

This dietary study was made in an Irish family, consisting entirely of adults. The old mother, 70 years of age, was very frail, but all the other members of the family were strong and well. There were five children, three sons and two daughters, and one boarder, a man. The older of the daughters, a woman 40 years old, managed the house. The other, 31 years of age, cleaned cars, and was paid at the rate of $25 a month for full time. During the month covered by the study she lost some time and earned only $21. The two oldest sons, aged 34 and 37 years, respectively, were skilled glass blowers, but were idle at the time. They were addicted to drink. The youngest son, aged 28 years, was a street cleaner, and earned $1.50 per day when employed. During the study (31 days) he earned $31. The boarder was an iron worker. He paid $4.50 per week for board and lodging.

The family paid $18 a month rent for a house, but sublet a portion of it for $7, making their actual rent $11 a month for 5 rooms.

The study began January 14, 1897, and continued 31 days.
The number of meals taken was as follows:

	Meals.
Men	334
Women (279 meals × 0.8 meal of man), equivalent to	223
Total number of meals taken, equivalent to	557

Equivalent to 1 man 186 days.

The amount and composition of the food purchased, wasted, and eaten, together with its cost, are shown in the following tables:

TABLE 24.—*Food materials and table and kitchen wastes in dietary study No. 191.*

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Chuck (11.3 per cent refuse)	19.0	12.6	.....	$0.88	3,960	753	499	.....
Chuck, fat (11.2 per cent refuse)	18.0	18.8	.....	1.26	6,145	1,106	1,156	.....
Flank steak	16.1	19.0	.....	.73	2,080	335	395	.....
Flank steak, fat	15.6	27.2	.....	.23	725	113	197	.....
Plate, medium fat (26.2 per cent refuse)	15.7	29.1	.....	.32	1,730	272	503	.....
Plate, lean (26.3 per cent refuse)	14.6	18.8	.....	.04	340	50	64	.....
Round steak, medium fat (1.8 per cent refuse)	19.8	13.6	.....	.75	2,660	528	362	.....
Round steak, fat (1.7 per cent refuse)	18.9	22.3	.....	.48	1,800	340	401	.....
Rump, medium fat (8.7 per cent refuse)	16.8	26.1	.....	.56	2,705	454	706	.....
Rump, fat (8.6 per cent refuse)	16.4	35.7	.....	.28	1,440	236	514	.....
Shoulder	16.1	9.8	.....	.50	3,135	505	307	.....
Sirloin steak	15.9	17.6	.....	.07	285	45	50	.....
Sirloin, small end (6.1 per cent refuse)	13.3	43.7	.....	.50	1,760	234	769	.....
Plate, corned (10.8 per cent refuse)	13.3	41.9	.....	.09	395	52	165	.....
Rump, corned (9.9 per cent refuse)	15.3	23.3	.....	.23	1,250	191	291	.....
Tripe	11.8	1.2	0.2	.50	2,890	341	35	6
Liver pudding[1]	20.9	5.0	1.6	.21	1,445	302	72	23
Total	.....	.....	.....	7.63	34,745	5,857	6,486	29
Veal: Shoulder (14.2 per cent refuse)	20.1	8.2	.....	.20	765	154	63	.....
Lamb: Shoulder (11.9 per cent refuse)	17.5	29.7	.....	.10	435	76	129	.....
Pork:								
Loin (11.7 per cent refuse)	16.7	31.3	.....	.97	4,030	673	1,261	.....
Ham (14.6 per cent refuse)	15.5	39.1	.....	.18	410	64	160	.....
Shoulder, smoked (14.1 per cent refuse)	15.8	32.5	.....	.20	1,070	169	348	.....
Shank (10.8 per cent refuse)	13.4	41.8	.....	.53	2,820	378	1,179	.....
Bacon (2.1 per cent refuse)	9.8	68.0	.....	.76	3,120	306	2,122	.....
Sausage	12.7	44.2	1.1	.52	2,335	297	1,032	26
Lard	.....	100.0	.....	.26	1,275	.....	1,275	.....
Total	.....	.....	.....	3.42	15,060	1,887	7,377	26
Poultry: Chicken (21 per cent refuse)	19.2	15.3	.....	1.00	2,935	63 5	449	.....
Fish:								
Codfish, shredded	22.2	.3	.....	.09	440	98	1	.....
Mackerel, salt	13.9	21.2	.....	.19	555	77	118	.....
Whitefish	10.3	3.0	.....	.30	1,095	112	33	.....
Total	.....	.....	.....	.58	2,090	287	152	.....
Eggs (13.7 per cent refuse)	15.0	11.0	.....	1.38	3,995	599	439	.....
Butter	.....	82.4	.....	3.16	6,675	.....	5,501	.....
Milk	3.3	4.0	5.0	1.30	23,865	788	955	1,193
Sucarcase[1]	4.3	4.0	5.0	.20	2,520	83	101	126
Total animal food	.....	.....	.....	18.97	93,085	10,294	21,652	1,374

[1] Composition assumed.

TABLE 24.—*Food materials and table and kitchen wastes in dietary study No. 191*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
VEGETABLE FOOD.								
Cereals:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Corn meal	9.3	2.4	74.9	$0.08	1,375	128	33	103
Flour	11.4	1.1	75.1	2.23	39,300	4,480	432	29,512
Flour, prepared	10.1	1.0	74.0	.05	1,220	123	12	903
Oats, rolled	16.6	7.2	66.9	.10	880	146	63	589
Rice	7.8	.4	79.2	.11	555	43	2	440
Bread	9.4	1.2	53.0	.78	9,525	896	114	5,049
Cakes, drop	7.6	14.7	60.3	.07	240	18	35	145
Crackers, soda	9.8	9.5	73.3	.07	440	43	42	323
Total				3.49	53,535	5,877	733	37,064
Sugars and starches:								
Sugar			100.0	2.05	18,345			18,345
Cornstarch			93.8	.01	40			37
Total				2.06	18,385			18,382
Vegetables:								
Beans, Lima, dried	18.1	1.5	65.9	.10	1,300	235	20	857
Corn, canned	2.8	1.3	19.3	.10	625	18	8	121
Celery (17.2 per cent refuse)	1.3	.1	3.8	.10	325	4		12
Onions (10.1 per cent refuse)	1.7	.4	10.2	.20	2,255	38	9	230
Potatoes (20 per cent refuse)	2.2	.1	18.8	1.02	34,350	756	34	6,458
Potatoes, sweet (17.9 per cent refuse)	1.8	.7	27.4	.21	2,995	54	21	821
Tomatoes, canned	1.1	.2	3.8	.38	3,835	42	8	146
Turnips, Swedish (18 per cent refuse)	1.3	.2	8.1	.10	4,335	56	9	351
Catsup	1.5	.2	12.3	.57	2,710	41	5	333
Pickles	.6	.3	3.4	.10	425	3	1	14
Sauerkraut	1.7	.5	3.8	.20	2,780	47	14	106
Vegetable soup	2.9		.5	.20	3,855	112		19
Total				3.28	59,790	1,406	129	9,468
Fruit:								
Apples	.3	.4	11.4	.73	18,780	56	75	2,141
Bananas	.7	.4	13.2	.10	780	5	3	103
Figs	4.3	.3	74.2	.15	610	26	2	453
Lemon	.7	.6	5.8	.01	60			3
Peaches, dried[1]	2.9		63.3	.09	225	6		142
Jelly and jam[1]	1.1		77.2	.17	1,785	20		1,378
Apple and tomato butter	1.2	.1	58.5	.46	2,355	28	2	1,378
Total				1.71	24,595	141	82	5,598
Total vegetable food				10.54	156,305	7,424	944	70,512
Total food				29.51	249,390	17,718	22,596	71,886
Accessories:								
Baking powder				.05	100			
Coffee				.69	555			
Nutmeg				.01	15			
Pepper				.04	45			
Salt				.06	2,665			
Total				.85	3,380			
Total cost of food and accessories				30.36				
WASTE.								
Beef:								
Chuck, fat	18.0	18.8		.07	325	57	61	
Round, fat	18.9	22.3			15	3	3	
Shoulder	19.3	11.3		.01	40	8	5	
Rump, fat	14.9	36.3			15	2	5	
Corned	15.3	23.3		.01	25	4	6	
Total				.09	420	74	80	

[1] Composition assumed.

TABLE 24.—*Food materials and table and kitchen wastes in dietary study No. 191*—Cont'd.

Kind of food material.	Composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Protein.	Fat.	Carbohydrates.
WASTE—continued.								
Pork:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Loin	16.7	31.3	.....	$0.01	25	4	8	.....
Shank	13.4	41.8	.....	.....	25	3	10	.....
Bacon	9.8	68.0	.....	.01	25	2	17	.....
Total	.....	.....	.....	.02	75	9	35	.....
Poultry: Chicken	19.2	15.3	.....	.01	25	5	4	.....
Fish: Whitefish	22.1	6.5	.....	.03	100	22	6	.....
Total animal waste	.....	.....	.....	.15	620	110	125	.....
Vegetables:								
Potatoes	2.2	.1	18.8	.03	900	20	1	169
Turnips, Swedish	1.3	.2	8.1	.....	270	4	1	22
Total vegetable waste	.....	.....	.....	.03	1,170	24	2	191
Total waste	.....	.....	.....	.18	1,790	134	127	191

TABLE 25.—*Weights and percentages of food materials and nutritive ingredients per man per day in dietary study No. 191.*

Kind of food material.	Weights.				Cost.	Percentages of total food.				Cost.
	Food material.	Protein.	Fat.	Carbohydrates.		Food material.	Protein.	Fat.	Carbohydrates.	
PER MAN PER DAY.										
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Cents.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Beef, veal, and mutton	193	33	36	.....	.....	14.4	34.3	29.6	.....	26.9
Pork, lard, etc	81	10	40	.....	.....	6.0	10.7	32.7	.....	11.6
Poultry	16	3	2	.....	.....	1.2	3.2	2.0	.....	3.4
Fish, etc	11	2	1	.....	.....	.8	1.6	.7	.....	1.9
Eggs	21	3	2	.....	.....	1.6	3.4	1.9	.....	4.7
Butter	36	.....	30	.....	.....	2.7	.....	24.3	.....	10.7
Cheese, smearcase	13	.....	1	1	.....	1.0	.5	.4	0.2	.7
Milk	129	4	5	6	.....	9.6	4.4	4.2	1.7	4.4
Total animal food	500	55	117	7	10.2	37.3	58.1	95.8	1.9	64.3
Cereals	288	32	4	199	.....	21.5	33.2	3.2	51.6	11.8
Sugars and starches	99	.....	.....	99	.....	7.4	.....	.....	25.6	7.0
Vegetables	321	7	1	51	.....	24.0	7.9	.6	13.1	11.1
Fruits	132	1	.....	30	.....	9.8	.8	.4	7.8	5.8
Total vegetable food	840	40	5	379	5.7	62.7	41.9	4.2	98.1	35.7
Total food	1,340	95	122	386	15.9	100.0	100.0	100.0	100.0	100.0

TABLE 26.—*Nutrients and potential energy in food purchased, rejected, and eaten per man per day in dietary study No. 191.*

Kind of food.	Weights and fuel value.				Cost.	Percentages of total food.				
	Protein.	Fat.	Carbohydrates.	Fuel value.		Protein.	Fat.	Carbohydrates.	Fuel value.	Cost.
PER MAN PER DAY.										
Food purchased:	*Grams.*	*Grams.*	*Grams.*	*Calories*	*Cents*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Animal	55	117	7	1,340	10.2	58.1	95.8	1.9	43.2	64.7
Vegetable	40	5	379	1,765	5.7	41.9	4.2	98.1	56.8	35.7
Total	95	122	386	3,105	15.9	100.0	100.0	100.0	100.0	100.0
Beverages, condiments, etc	.....	.....	.....	.....	.5	.....	.....	.....	.....	.....
Waste:										
Animal	1	1	.....	15	.....	.6	.5	.....	.3	.5
Vegetable	.....	.....	1	5	.....	.1	.....	.3	.1	.1
Total	1	1	1	20	.....	.7	.5	.3	.4	.6
Food actually eaten:										
Animal	54	116	7	1,325	10.2	57.5	95.3	1.9	42.9	63.8
Vegetable	40	5	378	1,760	5.7	41.8	4.2	97.8	56.7	35.6
Total	94	121	385	3,085	15.9	99.3	99.5	99.7	99.6	99.4

Discussion of results.—The members of this family were accustomed to rather more than the average amount of labor when all were at work. During the period of the study the average daily food consumed furnished 94 grams of protein and 3,085 calories of energy. While this was perhaps a rather scant ration if all had been at manual labor, it may be regarded as ample under the circumstances. Two of the family were idle, and the aged mother of course performed very little work. It is therefore not improbable that the average amounts of nutrients and energy in the food came very near to the actual bodily demands of the different members of the family.

The cost of the food per man per day (16 cents) was very moderate for the kind and variety of the foods purchased, while the beverages, condiments, etc., cost but one-half cent per man per day. All the foods were purchased in quantity, thus effecting a considerable saving.

The most expensive meat used was flank steak at 15½ cents a pound. Beef chuck at 9.6 cents and beef rump at 8.4 cents were cheap. As usual, flour was the cheapest source of both protein and energy, and bread the next cheapest, although the latter furnished but two-thirds the amount of protein and one-half the energy for the same expenditure. Eggs, as is quite frequently the case, furnished a comparatively small amount of protein and a very small amount of energy for the money expended.

The cost per pound and the amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of fifteen of the more important of the foods used are shown in the following table:

TABLE 27.—*Cost per pound and amounts and fuel value of the digestible nutrients in 1 pound and in 10 cents' worth of the more important food materials used in dietary study No. 191.*

Kind of food material.	Actual cost per pound.	Nutrients and energy in 1 pound.				Nutrients and energy in 10 cents' worth.			
		Protein.	Fat.	Carbohydrates.	Fuel value.	Protein.	Fat.	Carbohydrates.	Fuel value.
Beef:	*Cents.*	*Pound.*	*Pound.*	*Pound.*	*Calories.*	*Pound.*	*Pound.*	*Pounds.*	*Calories.*
Chuck	9.6	0.180	0.159	.....	1,005	0.19	0.17	.....	1,045
Flank steak	15.5	.157	.205	.....	1,155	.10	.13	.....	745
Round	12.3	.187	.163	.....	1,035	.11	.10	.....	825
Rump	8.4	.149	.261	.....	1,380	.18	.31	.....	1,640
Pork:									
Loin	10.0	.149	.276	.....	1,440	.15	.28	.....	1,440
Shank	7.6	.118	.364	.....	1,755	.15	.48	.....	2,305
Chicken	12.2	.149	.117	.....	770	.12	.10	.....	635
Eggs	13.5	.126	.092	.....	620	.09	.07	.....	460
Butter	21.5	.....	.799	.....	3,370	.....	.37	.....	1,570
Milk	2.5	.032	.039	0.050	320	.13	.16	0.20	1,270
Flour	2.6	.098	.010	.740	1,600	.38	.04	2.85	6,150
Bread	3.7	.080	.011	.518	1,160	.22	.03	1.40	3,125
Sugar	5.1	.....	.....	.980	1,825	.....	.....	1.92	3,575
Potatoes	1.1	.014	.....	.144	295	.13	.....	1.31	2,675
Catsup	9.5	.012	.....	.117	240	.01	.....	.12	250

GENERAL REMARKS ON THE DIETARY STUDIES.

The families studied represent a great diversity of occupation and financial condition. Care was taken to select as representative families as possible and it is believed the food consumption in dietary No. 43 is fairly representative of a professional man's family, that in dietary No. 190 of a skilled artisan, and that in dietary No. 191 of a skilled laborer. The average day laborer's family is represented in dietary No. 189, and that of the unskilled mill workman in Nos. 128 and 129. It is, of course, impossible from so few studies to make definite deductions regarding the actual living habits, and the character and amounts of food consumed by families under somewhat different conditions of labor and of environment.

It will be of interest to compare the amounts and proportions of nutrients in these dietaries with those found in similar studies in other places. This is done in the table below. The 14 families of professional men were those of college professors, teachers, chemists, and lawyers residing in Middletown and Storrs, Conn., Lafayette, Ind., Chicago, Ill., and vicinity, and Pittsburg, Pa. The mechanics' families resided in Middletown, Conn., New Brunswick, N. J., Knoxville, Tenn., and Lafayette, Ind.

TABLE 28.—*Summary of dietary studies here reported with averages of studies made elsewhere.*

[Quantities per man per day.]

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
	Cents.	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Dietary of a professional man's family (No. 43)	21	91	145	380	3,280
Dietary of a mill workman's family (No. 128)	13	85	104	307	2,575
Dietary of a mill workman's family (No. 129)	9	77	90	314	2,440
Dietary of a boiler tender's family (No. 189)	22	147	173	683	5,010
Dietary of a house decorator's family (No. 190)	20	112	144	368	3,305
Dietary of a glass blower's family (No. 191)	16	94	121	385	3,085
Average 14 dietaries of professional men's families [1]	[2] 25	104	125	423	3 325
Average 14 dietaries of mechanics' families [3]	[4] 20	103	150	402	3,465

[1] Connecticut Storrs Sta. Rpt. 1896, and U. S. Dept. Agr., Office of Experiment Stations, Bul. 32. Dietary No. 43 of this bulletin is also included and three dietaries of professional men in Illinois not yet published.

[2] Average of nine studies.

[3] Connecticut Storrs Sta. Rpt. 1896, and U. S. Dept. Agr., Office of Experiment Stations Buls. 29, 32, and 35.

[4] Average of five studies.

It will be seen from the above table that the food consumption of the family in dietary No. 43 was quite near the average for professional men's families. The other dietary studies made at Pittsburg, while representing the food consumption of people with moderate muscular labor, show no uniformity of results. Some contain a larger and some a smaller amount of nutrients than the average of 14 dietary studies of mechanics' families. All but one are below the tentative standard for a man at moderate labor.

The cost of the food "per man per day" varied considerably in the different studies, ranging from 22 cents in dietary No. 43 to 9 cents in dietary No. 129.

An examination of the data of the different studies will show that the less the income the more economical the expenditures for food (as shown by the amount of nutrients obtained) and vice versa. This is more noticeable in the case of the animal food than of the vegetable food and as regards the fuel value or energy of the food than its content of protein.

The variation in the average cost of nutrients is smaller in case of vegetable foods than in case of animal foods. This is doubtless due to the fact that the cereal foods, which furnished so large a part of the total nutrients, do not vary greatly in price. Thus flour and bread together furnished from one-fifth to one-third of the total nutrients in these studies, and the variation in the cost per pound was comparatively slight. The food materials containing the largest proportion of nutrients are the cheapest source of these nutrients. It is in the increased purchase of the higher priced meats, of vegetables, and of fruits that the increased cost of the food lies.

In brief, when the cost of living must be diminished, the cheaper cuts of beef, beans, peas, oatmeal, flour, or bread can be profitably used as a source of protein. So far as is known, such food materials are as wholesome and, when properly prepared and served so that

sufficient variety is secured, as acceptable as the more expensive foods. White flour or bread, sugar, rice, corn meal, oatmeal, potatoes, and the cheaper cuts of pork are economical sources of energy (fuel). If food variety rather than food economy is desired, this variety may be obtained by the use of expensive cuts of meat and considerable quantities of eggs, butter, green vegetables, and fruits.

FOOD ACCESSORIES.

In the previous discussions of the dietaries no mention has been made of the beverages, condiments, and other food accessories which give flavor to the food or increase its palatability, but have little or no food value in themselves.

Under the head of food accessories are classed tea and coffee, condiments, flavorings, etc. Pickles might very properly be classed under the same head since they are used more as a condiment than as a food. They have, however, some food value, and have been designated as food in the previous tables. Although the food accessories here used neither build tissue nor yield energy, they serve to make the food more palatable and may be of some aid to digestion by causing a more profuse secretion of the digestive juices and in other ways. They are an element of expense entering, to a greater or less extent, into the dietaries of all families. In the first dietary studied (No. 43) no account was made of these items, but in the subsequent studies the amount of food accessories consumed was determined.

For the sake of comparison the amounts of the various food accessories used in the different dietary studies are given in the following table. These quantities have been calculated for one man for one month (30 days) rather than for the family for one month, since the points to which it is desired to call attention are thus more clearly shown.

TABLE 29.—*Cost of food accessories per man per month (30 days) in the different dietaries.*

	Dietary No. 128.	Dietary No. 129.	Dietary No. 189.	Dietary No. 190.	Dietary No. 191.
Coffee	$0.51	$0.15	$0.14	$0.25	$0.69
Tea	.42	.71	.63	.13	.....
Salt	.04	.08	.02	.01	.06
Baking powder	.....	.....	.09	.....	.....
Mustard	.10	.18	.....	.....	.....
Vinegar	.08	.....	.....	.03	.05
Pepper	.05	.....	.01	.10	.04
Ginger	.....	.....	.04	.....	.....
Nutmeg	.....	.....	.....	.....	.01
Total cost of condiments	1.20	1.12	.93	.52	.85
Cost of food alone	24.52	16.26	6.91	18.89	29.51
Cost of food and condiments	25.72	17.38	7.84	19.41	30.36

It will be seen from the table that aside from coffee and tea there was a comparatively small expenditure for accessories. The actual cost of salt, flavoring extracts, pepper, etc., was very small. Tea and coffee

were the chief beverages, and the cost of these two materials made up the largest proportion of the money paid for food accessories. The largest amount expended for tea and coffee as compared with the sum paid for actual food materials was found in dietary No. 189, in which $6.91 was paid for food materials and 93 cents, or about one-seventh, for the food accessories. In dietary No. 128, $24.52 was expended for food materials and $1.20 for food accessories. While this sum was not large, it should be remembered that as compared with the standards this family had insufficient nourishment. The conclusion seems warranted that they could have advantageously expended this sum for flour, bread, potatoes, beans, or the cheaper cuts of meat. This sum expended for flour at the price actually paid per pound for that purchased would have added 8 grams of protein and 260 calories of energy per man per day to the diet. In the same way in dietary No. 129 the protein might have been increased 12 grams per man per day and the fuel value over 400 calories.

While tea and coffee are stimulating and refreshing as beverages, they are comparatively expensive and furnish little if any nutriment. Either cocoa, whole milk, or skim milk would furnish considerable nutriment besides being useful as a beverage. Of these materials the skim milk would furnish the largest food return for the sum expended.

VARIATIONS IN THE COST AND COMPOSITION OF BREAD.

It is, of course, to be expected that in any locality there will be more or less range in the composition of food materials. This variation is due in part to fluctuations in the water content of different specimens of the same kind of food and in part to varying proportions of the different nutrients. Changes in the amount of water affect directly the nutritive value of the food material. Changes in the proportion of the different nutrients do not always affect the nutritive value materially. Generally speaking, however, if the amount of protein is diminished the value of the food is also lessened, for it has been found that it is the nitrogenous constituents of the food materials which are the most expensive. Fluctuations in the relative amounts of fat and carbohydrates affect the fuel value, since the fuel value of the fats is $2\frac{1}{4}$ times that of the carbohydrates. In most vegetable foods the amount of fat is so small as to be of little importance, and the real question of value must lie in the proportion of protein to carbohydrates and in the amount of water.

From the data available it would appear that there is considerably greater variation in the composition of bread than of flour. In 169 analyses of flour[1] the water ranges from 9.3 to 14.3 per cent, averaging 12.3 per cent, while in 108 analyses of bread[1] the water ranges from 26 to 49.1 per cent, averaging 35.4 per cent.

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 28.

Since baker's bread forms so important an article of food with many families, especially in the large towns and cities, it is desirable to have abundant data concerning the extent of variation in its composition and cost. For instance, it is desirable to learn whether bread costing 6 or 7 cents a pound contains more actual nutrients than bread costing 2½ or 3 cents a pound; whether there is any marked variation in the amount of nutrients contained in the different varieties of bread made by the same or by different bakers, and whether the variations in composition are due to the relative proportion of nutrients and water or to a variation in the nutrients themselves.

The work here reported is very similar to that carried on by Professor Voorhees, of New Jersey.* Ten samples of bread purchased in the open market were analyzed, and the results are given in the following tables. In Table 30 the weight of the different loaves as purchased is given, together with the cost and composition on the fresh basis, while Table 31 gives the composition on the water-free basis and the actual heat of combustion per gram, as determined by the bomb calorimeter and as calculated.

TABLE 30.—*Weight and cost per loaf, cost per pound, and composition of fresh bread.*

	Laboratory No.	Weight of loaf.		Cost per loaf.	Cost per pound.	Composition of fresh bread.					Fuel value.
						Water.	Protein.	Fat.	Carbohydrates.	Ash.	
		Grams.	*Lbs.*	*Cents.*	*Cents.*	*Per ct.*	*Per ct.*	*P. ct.*	*Per ct.*	*P. ct.*	*Calories.*
Bread	594	1,115	2.45	8	3.3	26.0	11.3	0.5	60.7	1.5	1,360
Do	595	529	1.17	5	4.3	34.8	9.8	.9	53.3	1.2	1,210
Do	596	896	1.98	6	3.0	34.4	10.8	.4	53.0	1.4	1,205
Do	597	1,145	2 52	9	3.6	33.3	9.8	.4	55.3	1.2	1,230
Do	598	795	1.75	5	2.9	29.8	11.0	.6	57.2	1.4	1,295
Do	599	565	1.25	9	7.2	29.3	15.4	.7	53.0	1.6	1,300
Do	600	663	1.46	6	4.1	32.1	10.6	.4	55.6	1.3	1,250
Do	2559	594	1.31	5	3.8	35.6	10.3	.3	52.6	1.2	1,185
		1,061	2.34	10	4.3						
Do	2743	.....	.....	.....	3.0	34.6	9.2	.5	54.3	1.4	1,200
Do	2749	.....	.....	.....	3.0	35.8	9.7	.7	52.6	1.2	1,190
Average of 10 analyses	.....	.....	.....	.....	3.9	32.6	10.8	.5	54.8	1.3	1,240
Average of 140 analyses[1]	.....	.....	.....	.....	.....	35.1	9.4	1.2	53.2	1.1	1,215
Flour[1]	.....	.....	.....	.....	.....	12.1	11.2	1.2	75.2	.4	1,655

[1] From an unpublished compilation of analyses.

* U. S. Dept. Agr., Office of Experiment Stations Bul. 35.

TABLE 31.—*Composition of bread calculated to water-free basis, with the heats of combustion as determined by the bomb calorimeter and as calculated.*

	Laboratory No.	Composition.				Heats of combustion per gram.	
		Protein.	Fat.	Carbohydrates.	Ash.	As determined.[1]	As calculated.[2]
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*	*Calories.*
Bread	594	15.3	0.6	82.1	2.0	4,475	4,265
Do	595	15.0	1.4	81.8	1.8	4,460	4,310
Do	596	16.4	.6	80.9	2.1	4,405	4,275
Do	597	14.7	.6	82.9	1.8	4,390	4,265
Do	598	15.7	.9	81.4	2.0	4,415	4,285
Do	599	21.7	1.0	75.0	2.3	4,425	4,365
Do	600	15.6	.6	81.9	1.9	4,400	4,265
Do	2559	16.0	.4	81.7	1.9	4,300	4,265
Do	2743	14.1	.8	83.0	2.1	4,385	4,255
Do	2749	15.1	1.1	82.0	1.8	4,375	4,295
Average of 10 analyses		16.0	.8	81.3	1.9	4,400	4,285
Average of 135 analyses[3]		14.5	1.8	82.0	1.7		4,325
Flour		12.7	1.2	85.6	.5		4,320

[1] By the bomb calorimeter.
[2] On the supposition that 1 gram of protein, fat, and carbohydrates will yield 5.5, 9.3, and 4.1 calories, respectively. In the estimation of fuel values as distinguished from heats of combustion the factor 4.1 per gram is commonly used for protein compounds, thus allowing for their incomplete oxidation in the body.
[3] U. S. Dept. Agr., Office of Experiment Stations Bul. 28.

DISCUSSION OF RESULTS.

It will be seen from the above tables that there is a much greater variation in the price per pound of bread than in its chemical composition, and, moreover, that the variations in the latter bear little or no relation to those in the former. The lowest price per pound was $2\frac{3}{4}$ cents; the highest, $7\frac{1}{4}$; the average, $3\frac{3}{4}$ cents. The protein varied more than either the water or the carbohydrates, the lowest proportion being 9.2 per cent; the highest, 15.4 per cent; the average, 10.8 per cent.

Variations in the amounts of fat and of mineral matter are unimportant, as the quantities in any case are relatively small. The mineral matter probably varies little, aside from additions of salt and baking powders.

The variations in protein and carbohydrates are probably due, in a large degree, to differences in the kinds of flour and other material used. Since all samples were taken on the day the bread was said to have been baked, and were equally fresh, the variations in the water content may, perhaps, be attributed to the methods employed in the making, which render some breads more absorptive than others.

The variations in cost are dependent almost entirely upon the baker. Different makes of bread sell at different prices per pound, while the nutritive value may be essentially the same in all cases. As a rule, in the New Jersey samples, the larger the loaf the greater the cost per pound. The study in Pittsburg was too limited in extent to allow many definite deductions. The size of the loaf, apparently, had no direct bearing upon the price of the bread per pound. This depended rather upon the brand or trade name given by the maker.

It is interesting to note that while the average price of bread at the time these investigations were carried on was $3\frac{3}{4}$ cents a pound in Pittsburg, it averaged from 3.8 to 4.9 cents a pound in different cities in New Jersey, and was from 5 to 6 cents a pound in Middletown, Conn.

BAKERY EXPERIMENT.

The usual process of bread making is essentially as follows: Flour is intimately mixed with a certain amount of water (or milk), salt, and yeast, and usually with more or less sugar and butter or lard. The whole is then placed in a warm place, where the yeast plant grows and causes the carbohydrates, sugars, etc., to ferment, yielding alcohol and carbonic acid gas, which make the dough porous. During the process of baking, the alcohol and carbonic acid are mostly or entirely driven off, water escaping at the same time.

For sometime past apparent discrepancies in the results obtained from analyses of flour and of bread made from similar flour have led to the belief that there may be a loss of nutrients during the process of baking. The information on this point is limited.*

The experiment here reported was made in a small bakery in Pittsburg, and was conducted under the personal supervision of the writer. All the ingredients used in the process of bread making were weighed and the flour was analyzed. The other ingredients were so small in amount that they were not sampled. Their chemical composition was assumed from average analyses of similar articles. After baking, the bread was weighed and a sample at once prepared for analysis.

The following table gives the cost, weights, and percentage composition of the ingredients used in making the bread, and the amount and percentage composition of the bread made from them:

TABLE 32.—*Weights, cost, and composition of ingredients used in making bread, with the weight and composition of the baked bread.*

	Laboratory No.	Weights.		Cost.		Composition.				
				Per pound.	Total.	Water.	Protein.	Fat.	Carbohydrates.	Ash.
		Grams.	*Lbs.*	*Cents.*		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Flour	2558	21,670	47.75	$2\frac{1}{4}$	$1.08	10.94	14.19	1.24	73.17	0.46
Potatoes[1]	.....	1,050	2.32	2	.05	79.20	2.10	.10	17.80	.80
Sugar[1]	.....	127	.28	5	.01	.....	.....	.....	100.00	.....
Yeast[2]	.....	2,350	5.19	.....	.09	95.03	1.21	.04	2.17	1.55
Salt	.....	298	.66	.....	.01	.....	.....	.....	.....	100.00
Total	.....	25.495	56.30	.....	1.24	.....	.....	.....	.....	.....
Bread from the above	2559	[3]29,840	65.75	4	2.60	35.56	10.32	.26	52.64	1.22

[1] Percentage composition taken from average composition of such foods as given in U. S. Dept. Agr., Office of Experiment Stations Bul. 28.
[2] Water and ash determined. Nutrients assumed to be in same relative proportions as in average given in U. S. Dept. Agr., Office of Experiment Stations Bul. 28.
[3] Including water used in preparing the bread.

* U. S. Dept. Agr., Office of Experiment Stations Bul. 35.

In the following table the amounts, composition, and fuel value of the nutrients of the different ingredients and of the bread made from them are given:

TABLE 33.—*Weights and fuel value of nutrients in ingredients used in making bread and in the baked bread.*

	Total weight of nutrients.			Heats of combustion as calculated.[1]	Heats of combustion as determined.
	Protein.	Fat.	Carbohydrates.		
	Grams.	*Grams.*	*Grams.*	*Calories.*	*Calories.*
Flour	3,675	269	15,856	84,425	[2]85,595
Potatoes	22	1	187	895	[3]895
Sugar			127	520	[3]520
Yeast	28	1	51	375	[3]375
Total	3,125	271	16,221	86,215	87,385
Bread	3,083	78	15,708	82,085	[2]82,655
Apparent loss	42	193	513	4,230	4,730
Per cent of loss	1.3	71.2	3.2	4.9	5.4

[1] On the supposition that 1 gram of protein, fat, and carbohydrates will yield 5.5, 9.3, and 4.1 calories, respectively. See foot note to Table 31.
[2] Determined by bomb calorimeter.
[3] Calculated.

DISCUSSION OF RESULTS.

From Table 33 it will be seen that there was no material loss during baking except in the case of the ether extract. This accords with the experiments of Professor Voorhees[1] at New Brunswick, N. J., as will be seen by the comparison of the loss of fat during the process of baking shown in the following table:

TABLE 34.—*Loss of fat in baking bread, as shown in experiments in Pittsburg and New Jersey.*

	Weight of fat in raw materials.	Weight of fat in baked bread.	Loss.
	Grams.	*Grams.*	*Per cent.*
In the Pittsburg experiment	721	78	71
In the first New Brunswick experiment	2,638	1,133	57
In the second New Brunswick experiment	2,537	1,037	59

It would seem from the above results that either the fat is rendered partially insoluble in ether during the process of baking or that it has been volatilized. The fact that there is a very considerable loss in the fuel value of the materials in the bread as compared with that of the raw ingredients before baking indicates that the latter is the true explanation, for if the fats had simply been rendered nonextractable their heat of combustion would probably have remained unchanged and there would be no such pronounced loss of heat values as is actually the case.

The relative cost of the raw materials and of the baked bread.—It was shown in Table 32 that raw materials worth $1.24 when made into

[1] U. S. Dept. Agr., Office of Experiment Stations Bul. 35.

bread sold for $2.60, or an increase of 110 per cent over the original cost. In the experiment carried on in New Jersey the increase was 116 per cent. In other words, the consumer pays from $210 to $216 for bread made from raw materials costing $100. The labor of making the bread, rent of building, etc., are not taken into account, but would not in all probability account for the discrepancy, allowing a fair profit.

From the above it would seem that in the case of very poor families, like those reported in dietary studies Nos. 128 and 129 above, an important pecuniary saving would result if bread was baked at home. To the man in ordinary circumstances it must be always more a question of convenience and taste than of cost. In short, each family can best determine whether it is desirable to pay the baker for the trouble of making the bread and delivering it or whether the labor of making and the extra fuel for baking can best be provided at home.

As mentioned above, the actual cost per pound of bread is apparently less in Pittsburg than in the other cities where similar investigations have been carried on.